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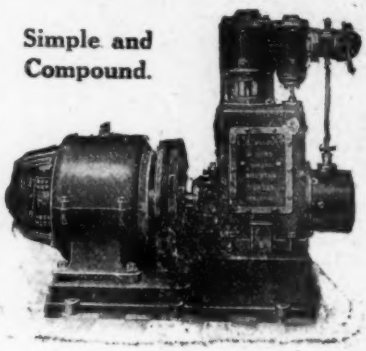

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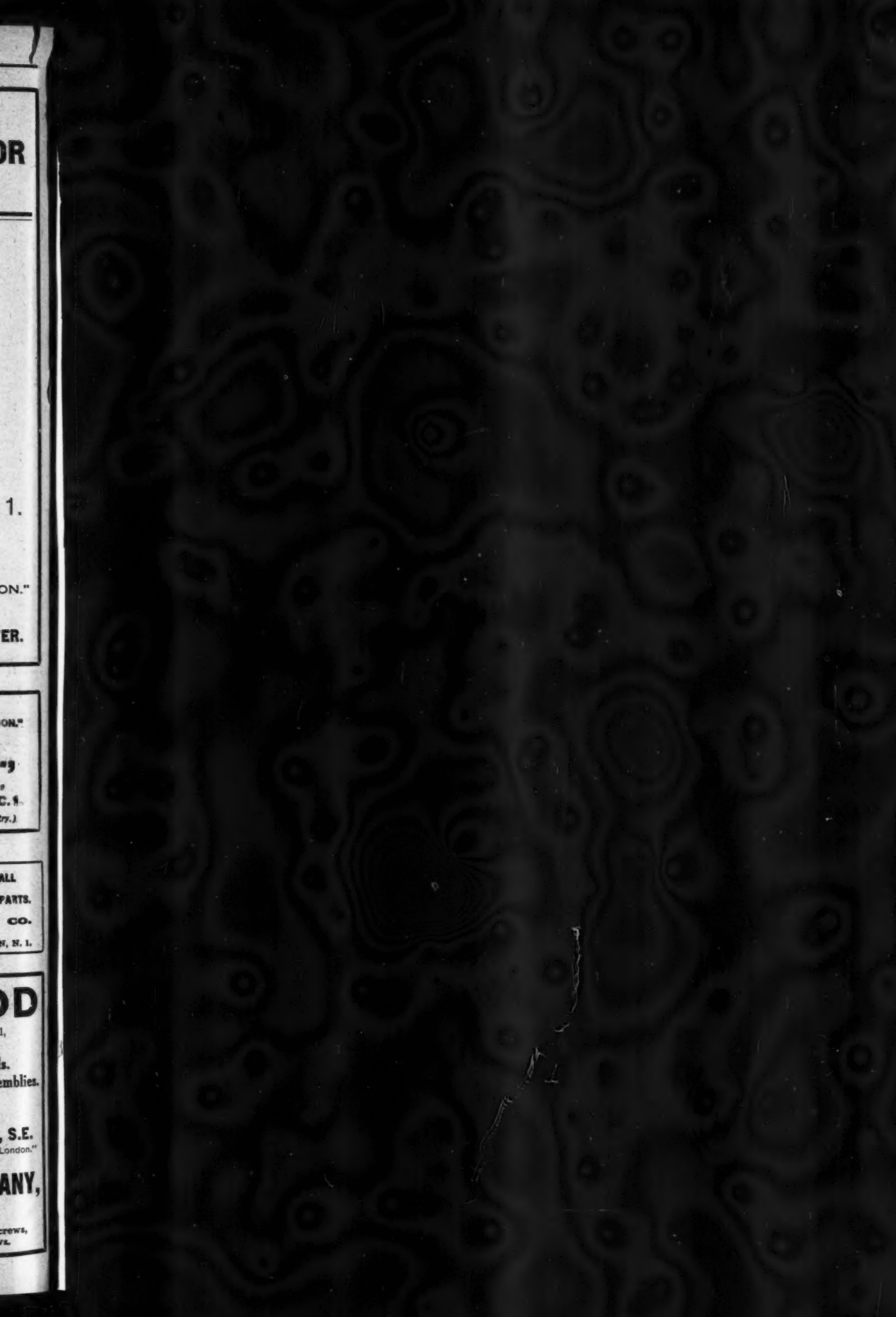

THE

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ELECTRICAL REVIEW.

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TO "ELECTRICAL REVIEW" READERS.

Owing to the continued increase in the circulation of the ELECTRICAL REVIEW in recent months, an increase which has become accelerated since the signing of the Armistice, we cannot guarantee that casual copies will be available. The only way to make sure of securing a copy regularly as issued, is to place a definite order with a newsagent, or else to subscribe direct to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

THE ELECTRIC PROPULSION OF SHIPS.

IN the annual Report of the Secretary of the U.S. Navy, made public in Washington in the second week in December, it was announced that "the most striking engineering accomplishment during the year was the completion of the electrically-propelled battleship *New Mexico*," which can be described as the most powerful naval vessel afloat. She displaces 32,000 tons, as compared with the 27,500 tons of H.M.S. *Queen Elizabeth*. The result of the trials of this battleship, it is said, confirms the judgment of the Department in adopting this type of machinery for the battle cruisers, and marks an engineering advance which will affect battleship construction the world over. Secretary Daniels in his Report says:—"The wisdom of this decision has been amply vindicated by the performance of the *New Mexico*, which has been tested in every way, her trials including many more than those specified in the contract. She has failed in none of them; the operation of her machinery has been highly satisfactory in every respect, and to-day, in this unique vessel, the United States Navy has a battleship which has no peer in the world's navies, not only for economic propulsion and less liability to serious derangement, but for her military superiority in greater manœuvring power and increased under-water protection." Mr. Daniels is further reported to have said that all capital ships of the future U.S. Navy are to be electrically propelled.

It will be recalled that the decision of the Navy Department led to the bitterest criticism, not only from engineers pecuniarily interested in other types of machinery, but also from others eminent in their profession who had no pecuniary interest, who feared that an experiment was being embarked upon which would be fraught with national calamity. This report, then, is a striking tribute to Rear-Admiral Griffin, chief of the Bureau of Steam Engineering, and his able assistants, who gave approval to this new method of propulsion, and who, despite the storm of protest, never lost faith in the ultimate triumph of electricity. The *Electrical World*, commenting on the Report, states that had the system of electric propulsion been perfected and standardised a year or two earlier, without a doubt the entire new United States merchant marine would have been equipped with it.

On reading such statements as the above, a question that naturally suggests itself—seeing that electric driving has been found satisfactory in other Navies, and that it can be safely said that with proper design and application electric driving is a well-tried and successful feature of both gun and turret operation, as well as the actual propulsion of ships of war—is: what are we in this country doing in the matter?

On January 9th, 1914, we expressed our opinion in these columns with regard to the statement that H.M.S. *Invincible*,

the only modern capital ship in the British Navy fitted with electric power throughout, was to undergo a long refit, at a cost of nearly £200,000, to replace the electric gun-operating gear by hydraulic mechanism. This, it should be remembered, was not on account of any failure on the part of the electrical gear, but simply because the British Admiralty was, and is, an institution with historic prejudices—prejudices that die hard. At the time we preferred to regard the refit merely as an incident, which in no way reflected on the adaptability of electric power for all purposes on a naval vessel, such adaptability, in fact, having been already demonstrated where traditional methods had less influence. Of the countries that, in the year previous to the war, had secured the advantages and efficiency that are consequent upon the use of electricity on board ship, progressive France topped the list, followed closely by the U.S.A. and Germany, and then by Austria, Russia, and Japan in turn, Great Britain's place, it is said to relate, being at the very end of the list.

This being so, we are tempted to inquire whether it is compatible with the dignity of the profession of electrical power engineering in this country patiently to endure such a state of affairs. Are we going to sleep over it? Or are we going to do the right thing—and do it now that we have the chance?

In our opinion, the reconstruction of our shipping affords a unique opportunity of demonstrating the adaptability and efficiency of electric power on board ship, and it behoves all concerned to see to it that the opportunities which are at hand are seized upon. A start in the right direction, it is true, has been made, as shown by the equipment of the first British sea-going electrical merchant ship, the s.s. *Wulsty Castle* (described in our issue of May 17th, 1918), and we trust that this will prove to be only the forerunner of many similar enterprises. It is to be hoped that prejudices will have been severely shaken by the events of recent years, and that in consequence the powers that be will be in a better position to appreciate that such innovations as we have referred to are, in the interest of progress, not to be ignored.

Electricity Supply Progress.

In our "Correspondence" columns to-day we are gently taken to task by Mr. J. C. Williams, of Erith, who has not, however, quite correctly interpreted our meaning; he says we referred "particularly" to the adoption of the three-phase system, but, in fact, we merely cited this as one example, out of the many that could readily be put in evidence of the general rule—that a small municipal undertaking is inherently unable to take any risk; it must follow the beaten track, which is to say that it must not be enterprising. Only the *large* undertakings can afford to experiment, and our argument was directed to showing that, as the municipal boundary system inevitably implied the multiplication of small undertakings, it necessarily hampered technical progress, besides producing the other ill-effects that we mentioned.

We congratulate Erith on having adopted the three-phase system so long ago as 1903; but even then Erith was hardly a pioneer, for electrical transmission and distribution on the three-phase system was in use in the United States in 1894 for lighting and power (with self-starting A.C. motors), and the Dublin tramways were provided with three-phase transmission and rotary-converter sub-stations in 1896. Manchester is precisely one of those large undertakings which can materially affect progress, and it has done so; though the five-wire system, unfortunately, did not fulfil expectations, it was an enterprising departure, and in other ways the city has certainly contributed valuable items to electro-technology.

As for the steam turbine, it was fostered and developed mainly in the works of the Newcastle and District Electric Lighting Co., from 1888 onwards; the Cambridge Electric Supply Co., Ltd., from 1892; and the Metropolitan Electric Supply Co., Ltd., from 1894. So far as we can ascertain, Halifax adopted the turbine about 1901, not 1897; and before 1889, 300 Parsons turbines had been built, aggregating 4,200 KW.

Amongst other penalties that we have paid for excessive sub-division is that of being tied down to the use of direct current. Where power is transmitted 5 or 10 miles—still more, 50 miles—the use of the three-phase system is most convenient, appropriate, and economical of capital and labour. But when every little township must have its own little station, with its own little staff, the advantage of a storage battery as a reserve is obvious, and partly from this cause, partly owing to the prevailing fashion, the D.C. system became the rule in this country. On the Continent, on the other hand, three-phase is practically standardised. Few of our stay-at-home engineers realise how very far behind other European countries we are in this respect.

Wherever a supply system extends over a large area, the three-phase system has been almost universally adopted; and wherever three-phase supply is available, three-phase distribution is the most suitable and economical method to employ. Consequently, on the Continent, where supply companies have been allowed to develop far more freely than in this country, the three-phase system is in common use. Moreover, the use of overhead conductors for the transmission system has familiarised the public with the idea; hence the prejudice against aerial lines which is rife in this country does not exist abroad, and overhead lighting and power mains are as common as telegraph or telephone lines.

Here, therefore, we have the Board of Trade Committee advocating those very things—widespread supply areas, concentration of generating plant, and overhead mains—which on the Continent are commonplace.

The "Grievance" of the "Unskilled" Man as a Soldier.

An important sentiment, which we have long anticipated would find forceful expression after the war, is contained in a report issued by the National Amalgamated Union of Labour. The skilled man was for a long time protected from compulsory military service by his essential occupation. It had to be so. The unskilled man was compelled to go and fight, suffer hardship, and perhaps die, and his family often suffered pecuniary loss, and will continue to do so. The skilled man, on the other hand, was required—and sometimes, we admit, desired—to stay at home earning good wages. The later stages of the war necessitated that from certain trades even skilled men should be called away to join the fighting Forces; it was occasionally only the threat of military service that made them ready to end some of their disputes which held up war supplies. Now that the war is ended, it is recognised that "no class has been harder hit by the war than the so-called unskilled man." The Union mentioned above says that the unskilled men's Unions raised no protest at the time, but in days to come unskilled men will expect somewhat different treatment from that which has been meted out to them in the past. "If they are good enough to be called on to die for their country, they have a right to look for something very different from the hardest and dirtiest work and the worst wages, which have been all that their country has hitherto had to give them."

The *Sheffield Independent*, commenting on the matter, says:—"The unskilled man is often such from no fault of his. He is the victim of circumstance. Fate is unkind. So quite light-heartedly, when danger threatens the country, we look to the unskilled man to stand in the breach. The unskilled man does his bit, but having done it, is it reasonable to expect him to come back to the country—his country, poor chap!—and submit to "the hardest and dirtiest work and the worst wages?"

There is an important point, however, that the Union and the Sheffield paper both appear to overlook—namely, that in the early days of the war the skilled man joined up for active service very readily. Indeed, more men of this class joined up under the voluntary system than proved to be in the national interest when we found how vitally necessary the production of munitions in engineering and other works was if we were to hold the line against the enemy. It would be unfair to overlook the fact that at certain stages of the war it became imperative that skilled men should be "called back" from France and from the Home Camps in order that they might follow their industrial calling. On the other hand, the unskilled man who went away to fight and comes back still unskilled will feel his position keenly in presence of the dilutee, whether man or woman, who has had the opportunity of becoming more or less skilled while he himself has been fighting. Will the unskilled fighter agree to undergo training and become a skilled man or dilutee? And shall we all resolve to work together to take advantage of the industrial boom that ought to come along, so that there may be work for all? We can find many bones of contention if we are so minded, and questions such as the above can only be settled satisfactorily if everybody shows good feeling and a resolution to arrive at a fair and equitable solution of the problem. The national promise to do well by those who have fought for us must be fulfilled. We stand under quite as great an obligation to them as we do to Trade Unions who claim the fulfilment of Government promises respecting the reinstatement of their pre-war rules and restrictions.

So far as electrical, mining, and other engineers are concerned, the number of men who have willingly made the supreme sacrifice, or who have been wounded or maimed in the war, must have been very large. Our own weekly Roll of Honour, published for several years past, has shown how great the electrical losses have been. We do not know whether it will ever be possible for the authorities to classify the casualties of the war according to trade or profession, but, if such is ever done, we do not think that the engineering sacrifice of life and limb will be small in comparison with those of other sections of the community. After all, the war—"an engineer's war," be it remembered—could not possibly have been won without the technical skill and knowledge which became increasingly essential in practically every department of the war operations, land, sea and air, right down to the last.

The Wire-Drawing Industries.

THE transition from war trade to peace trade in the wire manufacturing industries should not be attended with quite the same difficulties that other trades will experience, but the most enterprising firms will probably be well advised to leave nothing undone that can be effected as early in advance as possible. The suggestion that each important firm should be represented in future by a first-class representative, experienced in the trade, has, we believe, resulted in the decision of several firms never again to present foreign competitors with practically a clear field for operations. Many of the most formidable German competitors attributed no small share of their success in these markets to the efficiency and thoroughness of their representatives. With the view that a first-class representative stands for efficiency in sales organisation, and not necessarily for cut-throat competition, this section should more than justify itself wherever it is introduced.

The appointment, also, of representatives and agents for foreign markets is a matter that can lose nothing by being attended to well in advance. The decision to have nothing to do with promiscuous Russian and other foreign representatives is, doubtless, a judicious one; and several British firms will probably conjointly appoint a sole representative whose qualifications and credentials are beyond dispute or criticism.

A further section to which increased attention will be devoted in future is that of the merchant representation. Hitherto some of the British firms have offered no preferential terms to merchants, as is done with profit in other trades, with the result that German and American competitors, adopting a policy the exact reverse of this, have benefited considerably.

Most of the leading firms in this country have greatly extended their output capacity during the war, and one of the chief anxieties of the future is undoubtedly the necessity for increased turnover to justify the capital expenditure. Many of the leading American firms have also extended their productive capacity, but on a still larger scale, we understand, than many of the British firms. The result seems bound to be increased competition between the two countries. The necessity for increased efficiency in the sales section of all British firms thus becomes the more apparent.

Fuel Economy.

THE announcement of the Coal Controller that the altered conditions now permit of an increased supply of gas and electricity for fuel and lighting to domestic consumers will be heartily welcomed not only by the consumers themselves, but also by the electricity supply authorities; and as at the same time the restrictions upon the installation of gas and electrical fittings are completely suspended, their pleasure will be shared in by electrical contractors and manufacturers. The restrictions which had to be imposed during the past year have greatly hindered progress in this important branch of the electrical industry, and while on patriotic grounds they were patiently endured, their removal will confer great benefit upon a large body of workers. The step has been made possible by the moderation of the heavy demands upon gas and electricity for industrial purposes, consequent upon the Armistice, which has enabled a larger supply to be placed at the disposal of household consumers; in industrial areas the power demand has naturally fallen off enormously, affording a welcome opportunity to the station staffs to overhaul the plant and carry out the many necessary repairs which have accumulated, in readiness for the resumption of the load when manufacturers have completed their arrangements for changing over to peace production.

The situation in the contracting business has been very uncertain since the Armistice was signed, as many of the Government contracts which were in progress came to a standstill, and, while there was plenty of civilian work in contemplation, customers were not disposed to move very energetically in the matter until the conditions were more favourable; the removal of the restrictions, however, will clear the air, and renewed activity may be confidently expected to result therefrom.

Co-operation Among Smaller Manufacturers.

WE desire to draw special attention to a letter from Mr. H. C. Siddeley, which appears in our "Correspondence" columns to-day. Our own views on the pressing need for the smaller specialist manufacturers to take serious action in the direction of co-operative effort in either production or salesmanship, or both, expressed in these pages many times during the last four years, were reiterated in our leading article of last week. The comments—whether critical or advisory—of the technical Press generally occasion a good deal of discussion in the circles directly interested in the particular matters ventilated, but under the heavy pressure of work imposed by war munitions production, and because of the uncertainty which hung over everything while hostilities continued, men of weight and experience have often been "too busy to write," or disinclined to do so, until the times were more propitious. The war being practically at an end, the subject of co-operation seemed to us to be one of the first for serious discussion in this New Year, and we trust that now that our manufacturers have got their heads deeply into their arrangements for securing a long period of profitable industry in both home and export trade, those who are best qualified to deal with the subject will follow the excellent lead set by Mr. Siddeley, and express their views through the medium of our pages without delay. There is a time when coming together in conference may reasonably be expected to lead to definite conjoint action.

ELECTRICITY SUPPLY IN SHEFFIELD.

(Concluded from page 10.)

The generating plant is housed in a long, lofty room, well lighted from the roof and one side wall; the original switchboard, of the cellular type, is mounted on a gallery crossing the north end of the room, but the new switchboard is arranged along the west side wall, with a gallery in front of it, from which gangways give access to the driving platforms of the large generating sets. Beneath the switchboard gallery are the offices for the station superintendent and the operating staff, and the chemical laboratory. The room is lighted with half-watt lamps. The walls are faced with white enamelled brick; the roof is carried on steel framework, and is matchboarded to prevent the dripping of condensed moisture on the generators, for which purpose also iron screens are suspended over the generators. Two cranes are provided—one to lift 30 tons, the other with two lifts of 50 and 10 tons respectively.

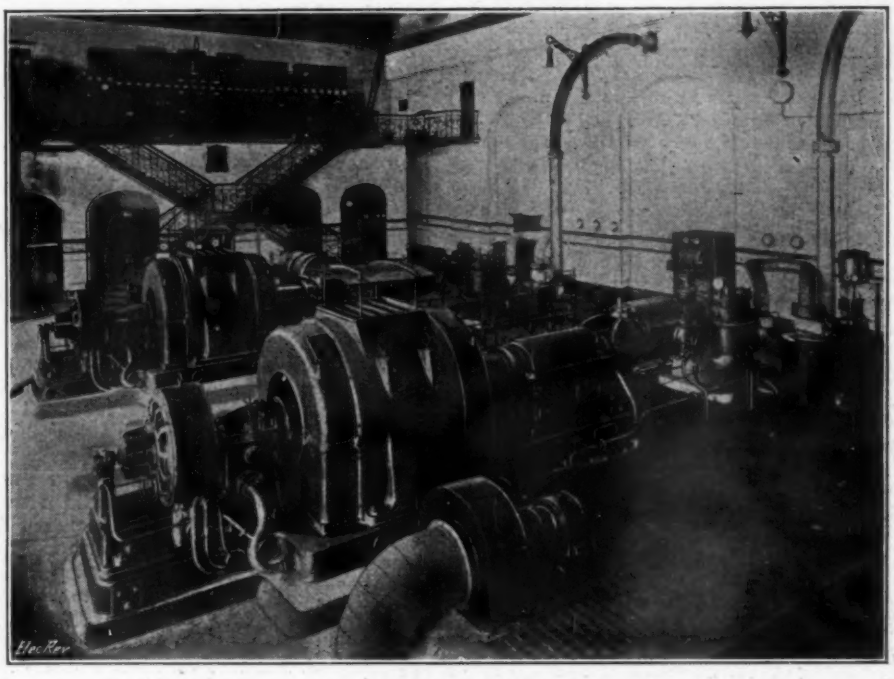


FIG. 13.—PARSONS 2,000-KW. GEARED TURBO-ALTERNATORS AT NEEPSEND.

The generating plant comprises ten polyphase sets. In the earliest part of the station two 1,500-KW. Parsons two-phase turbo-alternators with revolving armatures were installed, but these have recently been replaced by two Parsons 2,000-KW. two-phase geared turbo-alternators, the turbines running at 5,000 R.P.M. and the generators at 1,500 R.P.M. We give a view of these sets in fig. 13. The increased economy of the new turbines has enabled them to be mounted on the original 1,500-KW. condensers without detriment to the vacuum obtainable. With the exception of these two sets and No. 6A, which are mounted at floor level, all the turbo-alternators are set on

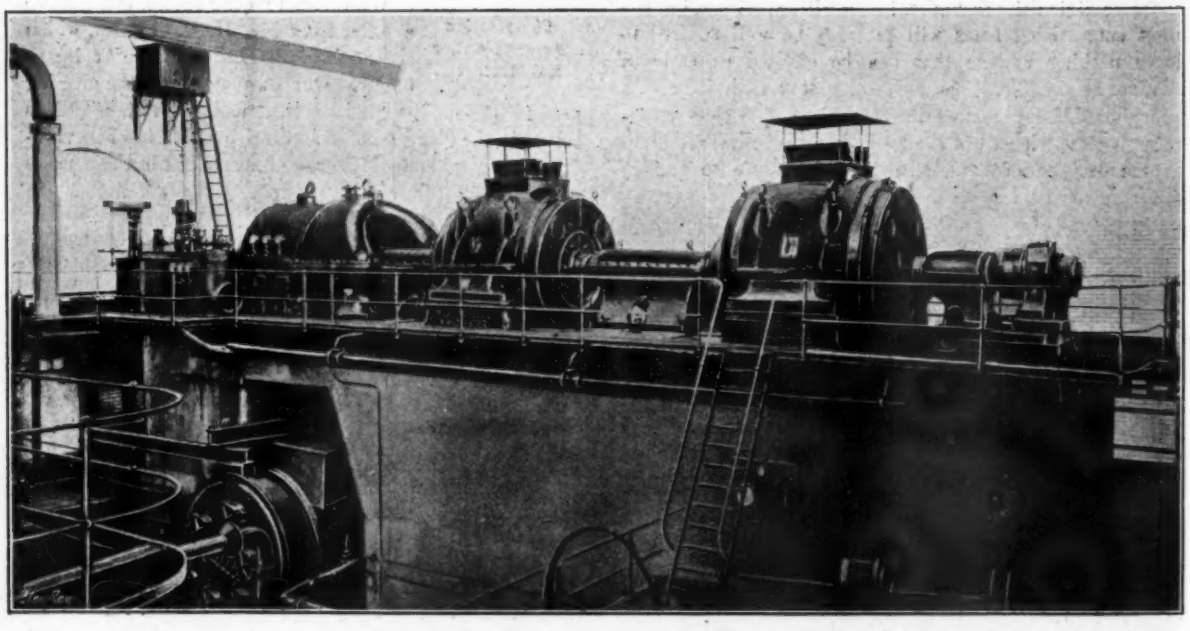


FIG. 14.—WESTINGHOUSE-SIEMENS 9,000-KW. TURBO-GENERATOR.

concrete pedestals above the floor, as shown in our illustrations, the floor level of the basement being only a few feet above the level of the river.

No. 3 set is a Willans-Dick, Kerr 4,500-kw. turbo-alternator, the turbine in this case being of the pure reaction type; Nos. 4, 5, and 6 are also Willans-Dick, Kerr sets, No. 4 of 6,000 kw. and Nos. 5 and 6 each of 8,500-kw., with combined impulse-reaction turbines and Willans condensing plant. No. 6 condensing plant is of the Willans-Muller extraction type, which does not require a separate air pump.* Nos. 3 to 6 have six-pole fields, and run at 1,000 r.p.m. Nos. 7, 8, and 9 run at 1,500 r.p.m.; of these the first two are Parsons sets, of the pure reaction type, rated at 8,500 kw. each, and have both electrical and steam auxiliaries. We illustrate Nos. 6 and 6a in fig. 15, and No. 9 in fig. 14; the last is provided with a Contraflo condenser and Kinetic air-pump, made by Messrs. Richardsons, Westgarth & Co.

Set No. 6a is a Westinghouse-Rateau turbo-alternator of 2,000 kw. capacity, generating at 3,300 volts, 50 cycles, three-phase, at 3,000 r.p.m. The turbine is of standard design, and consists of a velocity element followed by several Rateau stages, working under a steam pressure of 200 lb. per sq. in. gauge, superheated 150° F., and exhausting into a vacuum of 28½ in. at full load.

three-phase, 3,300/11,400-volt, oil-insulated, self-cooled transformers.

Set No. 9 is a Westinghouse 9,000-kw. turbine running

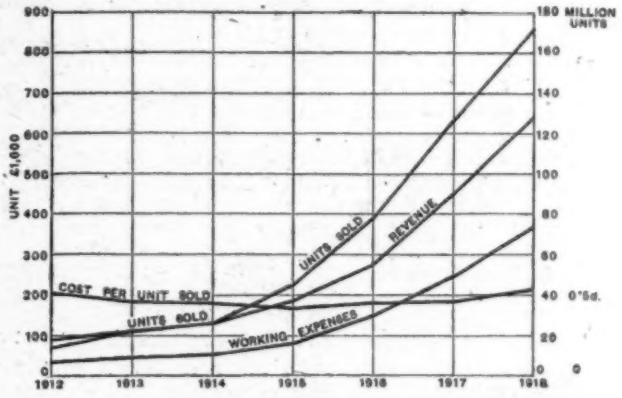


Fig. 16.—Progress Diagram of Sheffield Electricity Department.

at 1,500 r.p.m., and coupled to two Siemens alternators. The steam and vacuum conditions are the same as those for

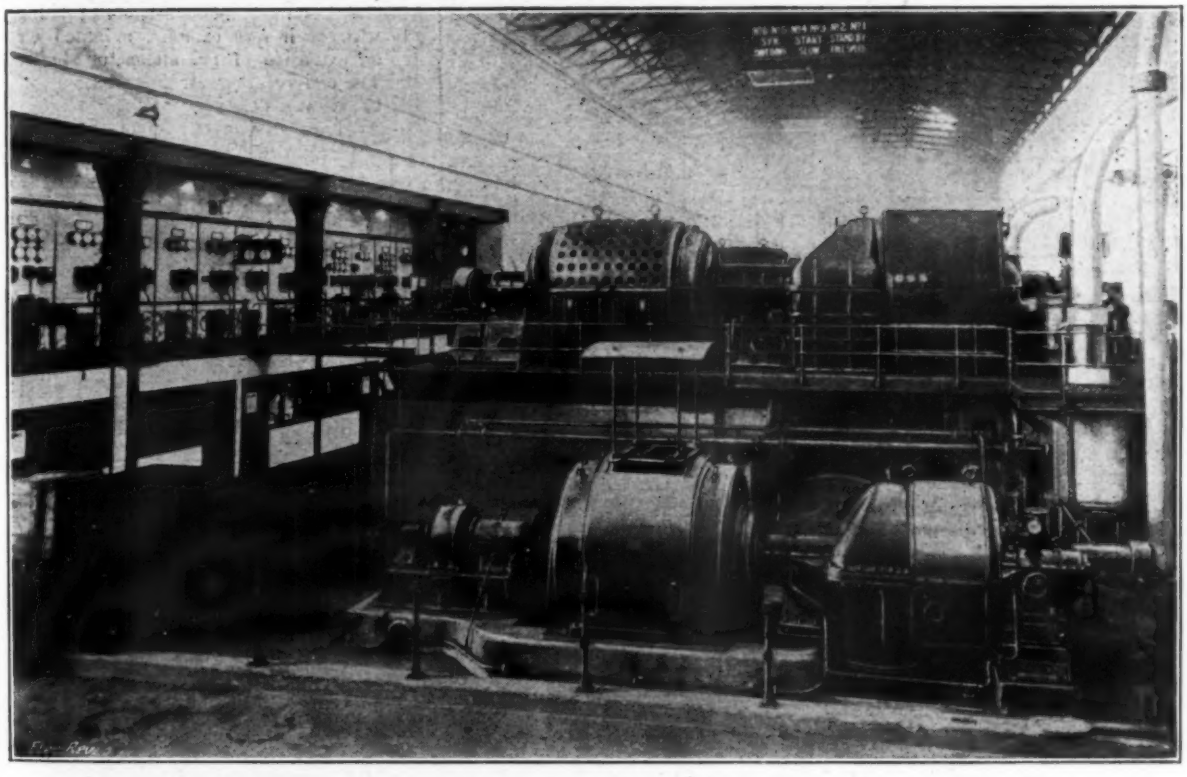


Fig. 15.—Willans-Dick, Kerr 8,500-kw., and Westinghouse 2,000-kw., Turbo-Generators.

The armature winding of the generator is of the concentric type, made up of separate bars and end connectors. The bars are insulated with mica and impregnated before they are placed in the semi-enclosed slots.

The rotor is of the smooth cylindrical radial-slot type, the field core being forged solid with the shaft. The field coils are held in the slots by means of metal wedges, and the connections are held by means of steel and bronze rings.

The surface condenser is of the double-flow type. The air and extraction pumps are of the Le Blanc rotary valveless type, driven by a 20-h.p. motor at 1,440 r.p.m. A separate lift pump for further raising the condensate is driven by a 5-h.p. motor at 1,440 r.p.m. A centrifugal circulating pump is driven by a separate motor.

The generator is electrically connected to two 1,250-k.v.a.,

the 2,000-kw. turbine described above, and the general design of the turbine also follows the same lines.

The electrical portion of this set was supplied by Messrs. Siemens Brothers Dynamo Works, Ltd., and was built at their Stafford Works. The plant was ordered in the autumn of 1915 for very urgent delivery, and certain parts existing in the works of the contractors were diverted by the Ministry of Munitions for the execution of the order. Thus it became necessary to make up the total output required by combining two 4,500-kw. alternators coupled in tandem and running at 1,500 r.p.m. The machines are wound for 6,600 volts, and operate in conjunction with transformers stepping up to 11,400 volts.

The turbine set throughout is fitted with solid couplings, and the two alternator-transformer units are permanently connected in parallel with each other, and are supplied with exciting current from one exciter.

*See Electrical Review, September 26th, 1913.

Each machine has a normal rating of 6,925 k.v.a. at any power factor between 0·65 and unity, and the machines deliver three-phase current at 50 cycles, with a temperature rise on normal full load not exceeding 45° C.

The design of the generators follows the makers' standard practice, ventilation being on their well-known axial system, and the rotor core and shaft ends consisting of one solid forging. The machines draw their cooling air through wet air filters of the revolving drum type, supplied by Messrs. Heenan & Froude.

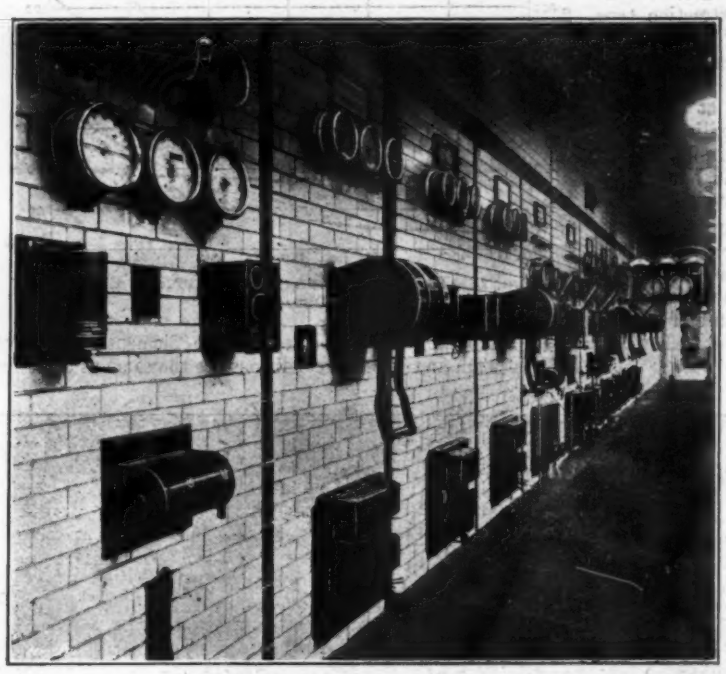


Fig. 17.—Front View of Switchgear.

The transformers to which each machine is connected are of Messrs. Siemens's three-phase water-cooled oil-insulated type, with a transformation ratio of 6,600/11,400 volts, and a temperature rise on normal full load of 55° C. Each transformer is fitted with the makers' patented expansion vessel to prevent sludging of the oil.

No difficulty whatever has been experienced in operation with the somewhat unusual tandem arrangement, and we understand that the plant has responded in the most satisfactory manner to the heavy demands made upon it during the war period.

The apparatus for cleansing and cooling the air supplied to the 9,000-kw. set consists of two 90-in. diameter "Heenan" air filters, arranged in parallel, and driven by one motor, developing ¾ h.p., through machine-cut spur and worm gearing. Each of these filters dealing with 20,500 cb. ft. of air per minute, the combined capacity of the set amounts to 41,000 cb. ft. per minute.

The machines each contain two filtering and cooling cylinders, built up of galvanised steel by Heenan and Froude's patented process; these are slowly revolved through water contained in the filter tank, which causes a thin film of water to adhere to the plate surfaces. The air passes through the narrow annular passages between the successive layers of plates, and is thoroughly scrubbed before issuing at the outlet of the machine to pass to the alternator. Means are provided for scraping out of the tank the sediment resulting from the extraction of the mechanical impurities from the air entering the filters, and moisture eliminators are fitted to prevent the passage of loose moisture to the alternator.

The governing gear of No. 9, which is operated by an oil-relay system, has proved particularly satisfactory, and may be adopted for other sets when a convenient opportunity occurs. The governor is controlled from the switchboard by an electric motor. An emergency oil-pressure system is provided, which is operated by a Worthington steam pump.

Each of the generating sets is provided with electrically-driven two-phase auxiliaries, controlled by switchgear mounted near the turbine; in addition, Nos. 7 and 8 sets have steam turbine-driven air and circulating pumps. Nos. 6A and 9 are the only sets provided with air filters. All the turbines are fitted with steam separators on the main steam pipes, and Nos. 1 and 2 have motor-driven cooling fans mounted alongside of the bed-plates.

All the generating sets are provided with their own exciters, mounted on an extension of the alternator shafts. The reciprocating air pumps are all of the Edwards type.

The aggregate output of the plant at full load is 59,500 kw.

The generating sets are cleaned by women, whose work is highly spoken of; they have been engaged on this duty for four years, and take a pride in their work, which, we understand, is done better than by men.

The switchgear is mounted on the west wall of the turbine room, on a gallery which extends two-thirds the length of the building; the floor of the gallery is on a level with the foot-plates of the large generators, with which it communicates at intervals by means of gangways. The gallery crosses the passageway which bisects the turbine room, and in order to provide for the admission of loaded wagons, a drawbridge with counterweight is provided, which is normally lowered, connecting the two sections of the switch gallery. The whole of the switchgear is of Messrs. Reyrolle's make, and is operated by hand; the wall is faced

Fig. 18.—Reyrolle Ironclad Switchgear.

with white enamelled brick, and the instruments, switch-handles, &c., are mounted directly on it, as shown in our view, fig. 17. All the generators are provided with Merz-Price protective gear, the operation of which also opens the exciter circuit.

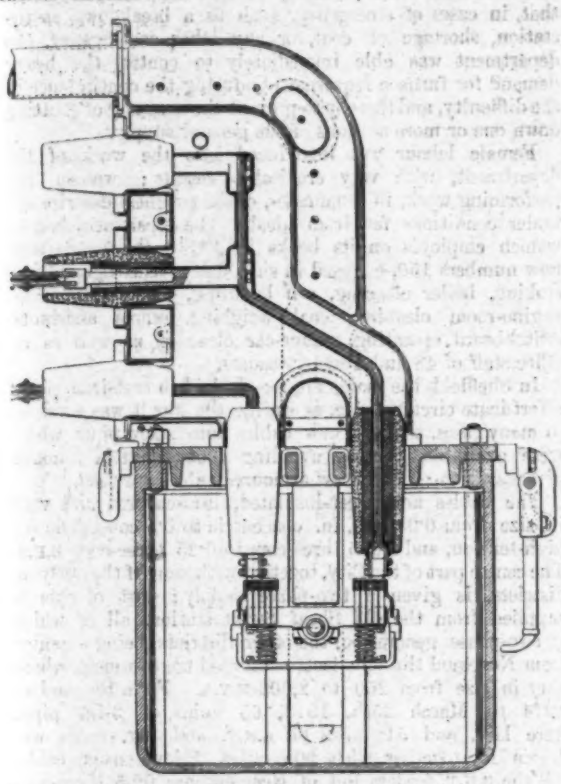


Fig. 19.—Reyrolle Ironclad Switch; Sectional Elevation.

The feeders are equipped with Reyrolle's overload and leakage protective system, and are being changed over to the split-conductor system of protection as the opportunity arises, two similar cables being grouped together for the purpose, and treated as one.

The ironclad switchgear itself is placed in two rooms behind the corresponding sections of the switchboard; the latest of these is shown in fig. 18. The switches are of a very substantial type, provided with boiler-plate-steel tanks and machined flanged joints; the tanks contain a large volume of oil, and all three phases are housed in one tank. These tanks and top plates are designed to withstand internal pressures of 400 lb. per sq. in., and a system of vent-pipes is provided to allow for the exhaust of gases. All the conductors are completely enclosed in metal chambers, and are run in solid in compound, or surrounded with oil. No insulators are exposed, and thereby cleaning and other maintenance costs are avoided.

Two main bus-bars are provided, which can be interconnected by a switch capable of carrying the maximum capacity of the station, or run separately (the normal condition). The switches are arranged, as shown in fig. 19, so that by changing a contact plug, which fits into a socket with a bayonet joint, they can be connected to either bus-bar, the operation of changing over, when the switch has been run back, being a matter of seconds. An indicator is provided to show whether the switch is on the top or bottom bar. Above the bus-bar contacts is seen the iron vent-pipe. The switches in the newer part of the station embody various improvements over those installed earlier, the generator panels being of a heavier type and the handle gear of an improved pattern, with lever and rod connection instead of wire rope; moreover, the automatic mechanism is contained in the switch hood instead of being mounted on the switch wall. The potential transformers are situated between the draw-out switch sections and the bus-bar sections of the gear, and cannot be got at without first racking out the switches; and the bus-bar contacts are automatically covered when the switch is drawn out, so that accidental contact with any live part is impossible. The switchgear, as a whole, is of very massive construction, and has been aptly compared with heavy hydraulic machinery.

Provision is made for dividing the new part of the bus-bars from the old at the central passage-way by a hand-operated oil-break switch: the bus-bars can also be sectionalised by means of couplings between the panels if required.

The switch room has a concrete roof and floor, and is well lighted from the side. Coloured lamps on the front of the board show whether the switch is in or out, and on which bar, as the position of the handle does not give this information.

Rotary synchroscopes are provided, carried, with the voltmeters, on brackets which enable them to be seen from either end of the gallery. Illuminated signalling boards are suspended above the cranes in each half of the station, which enable the attendants to signal instructions to the drivers; to call attention to these boards through the roar of the running machinery, various devices were tried, without success, but a Klaxon horn solved the difficulty, and has proved completely satisfactory. Illuminated signals in the boiler house are also provided.

The old switchboard is now used entirely for the control of the station power plant, which is driven by two-phase motors; it is coupled with the main board through three 2,000-K.V.A. sets of Scott-connected transformers reducing the pressure from 11,000 to 2,000 volts. The auxiliaries are worked at 2,000 and 200 volts, and are controlled by Reyrolle switchgear, with Berry transformers when necessary. Duplicate supplies are taken to the pump rooms from the main and auxiliary boards to ensure continuity of operation.

An automatic intercommunication telephone system of the dialling type gives ready communication between all parts of the station.

Fig. 20.—Switchgear in Sub-station (Main Switch on Left).

While the station is practically complete, there remain a few finishing touches to be added. A fitting shop is to be erected, but in the meantime, a room below the switchboard is used for this purpose. There is an admirably arranged fire-proof oil store adjoining the station, with five underground tanks in concrete, three

being of 1,500 gallons capacity and two of 500 gallons each. The oil is raised from these by Bowser self-measuring pumps, with which a mistake is practically impossible. Near the store is the welfare and ambulance department, presided over by two capable women attendants, who deal with some 1,200 cases a year—most of them, of course, of minor importance. A pay office is also provided, and a system has been adopted which enables the whole of the employés to be paid in nine minutes. Fire pumps are installed in the tower pump house, which are used to keep the cooling tower timbers saturated inside and outside, every tower being sprayed once a week; these pumps also serve the fire hydrants.

In addition to the extensions at Neepsend, of course all other departments had to expand in proportion. The

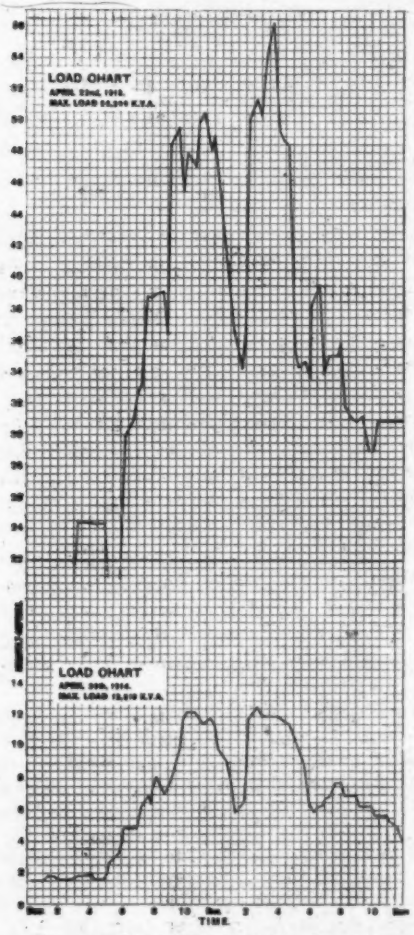


Fig. 21.—Load Charts, 1914 and 1918.

Mains Department had to make provision for distributing the extra amount of current generated, which involved the laying of 91 miles of cable, the erection and equipment of new sub-stations in different parts of the City, and the installation of additional switchgear and other controlling apparatus in many of the existing sub-stations. During the war period new works under the purview of the Mains Department were put in hand representing an expenditure of approximately £236,276.

Here, as elsewhere, the progress of work was limited by the shortage of labour. When carrying out large feeder-cable extensions from Neepsend to the east end of the city, the work was proceeded with at night by lighting the trenches. Advertisements were issued for week-end work, to attract men who were free from other employment only at that time, and special arrangements were made for paying them on the spot each Sunday night. Good results accrued from this procedure, and the completion of the work was considerably expedited thereby.

Another innovation which was introduced as a result of the necessity of working with such a fine margin between capacity and demand was a complete private telephone system connecting the department directly with most of the large electric furnace installations, special facilities being granted by the Ministry of Munitions for the construction of these lines. The advantage of this interconnection was that, in cases of emergency, such as a breakdown at the station, shortage of coal, or any other contingency, the department was able immediately to control the heavy demand for furnace requirements during the continuance of the difficulty, and thereby to prevent the necessity of shutting down one or more sections of the general supply.

Female labour was introduced into the work of the department, with very creditable results; women are performing work, in some cases, of the roughest description, under conditions far from ideal. The department had no women employés on its books in 1914; the female staff now numbers 150, engaged in such duties as coal handling, stoking, boiler cleaning, ash handling, general labouring, engine-room cleaning, coal weighing, stores assistants, switchboard operating, motor-car cleaners, as well as an office staff of 48 and 4 meter readers.

In Sheffield the mains are mostly laid in cast-iron pipes, a fortunate circumstance, as during the war it was possible, in many cases, to draw new cables into spare pipes which were available, thereby avoiding a considerable amount of excavation; only a few armoured cables are used.

The cables are paper-insulated, lead-covered and vary in size from 0·025 sq. in. concentric to 0·5 concentric for high-tension, and 0·025 three-core to 0·25 three-core E.H.T. The centre part of the City, together with some of the outlying districts, is given a two-phase supply; part of this is supplied from the old Sheaf Street station, all of which is two-phase generation, the other districts being supplied from Neepsend through Scott-connected transformers, which vary in size from 250 to 2,000-K.V.A. From the end of 1914 to March 25th, 1918, 65 miles of 3-in. pipes were laid, and 51 miles of E.H.T. and H.T. cable was drawn in, together with 20½ miles of low-tension cable. All the E.H.T. feeders out of Neepsend are 0·25 three-core E.H.T. In several cases two of these feeders have been arranged for split-conductor working, forming a 10,000-K.V.A. feeder. We give a view of the switchgear in a typical sub-station, showing one of the large split-conductor switches; the load on these switches varies between 6,000 and 10,000 K.V.A. The main switch is capable of carrying 750 amperes, and the breaking capacity is put down at 100,000 KW. This sub-station was erected before the war, and is now associated with an electric furnace, spare land having been available on the site belonging to the Corporation. Thus the furnace was brought to the sub-station, the steel works growing up round the latter—an inversion of the usual procedure. Messrs. Reyrolle's switchgear, of the type similar to the smaller sizes (illustrated), is used on all the E.H.T. sub-stations. The outgoing circuits have overload protection, the trip gear being operated by a primary battery.

Ninety-five per cent. of the cables used in Sheffield are of Messrs. W. T. Glover's manufacture. The E.H.T. cables are provided with the maker's patent test sheath, the value of which is much appreciated. A novel method of identifying the cables, devised by Mr. W. J. Howard, mains engineer, is about to be brought into use in all the new feeders to be laid to the Blackburn Meadows station; it consists in drawing on the lead sheaths one, two or more corrugated ribs on the external surface, by means of which a cable can be identified, not only by sight, but also by touch. This corrugation, running the whole length of the cable, can be seen at any opening that may be necessary thus avoiding the use of labels, which are often lost, or illegible when required. The mains are laid along a frontage of 195¼ miles, there being 136½ miles of 3-in. pipe laid in this frontage, together with 38 miles of 4-in. pipes, into which are drawn 185 miles of H.T. and E.H.T. cable and 168 miles of low-tension cable, exclusive of the tramway feeders.

The total number of electric furnaces connected to the mains is 51; these are of various types—namely, 27 Heroult, 14 Greaves-Etchells, 8 Electro-Metals, and one each of the Rennerfelt, Kjellin, and Chetwyn types. There are also 12 rolling mills connected, the largest motor being of 600 H.P.,

A.C. There are 217 motors on hire, aggregating 855 H.P., and 52 cookers, rated at 327 KW. The load is continually growing, the maximum demand having increased from 12,519 K.V.A. in 1914 to 58,909 K.V.A. in 1918, as will be seen on the accompanying load curves (fig. 21). The station load factor has remained during the four years practically constant at 40 per cent.

The "emergency station" which is being erected at Blackburn Meadows will contain plant of 28,000 KW. capacity, the boilers being of Stirling and Clarke-Chapman make, and the turbo-generators by Parsons, Willans, General Electric Co., and the British Thomson-Houston Co. Spray coolers have been adopted instead of cooling towers.

The Sheaf Street station is rated at 4,000 KW., and Kelham at 5,725 KW. A new station is in contemplation, to be of no less than 100,000 KW. capacity, so it will be seen that Sheffield is not going to rest on its laurels.

This article would not be complete without some reference to the other side of the subject—from the consumer's point of view. The undertaking, like others, has felt the effects of the increased cost of coal and labour, and the higher rate of income-tax; but, owing no doubt to the greater economy attained with the newer generating plant, the consumer has not felt them to the same degree. The average prices obtained during the past five years are as follows:—

	1918.	1917.	1916.	1915.	1914.
Light and heat ...	2·32d.	2·22d.	2·17d.	2·34d.	2·54d.
Power	·79d.	·74d.	·71d.	·72d.	·73d.
Total average price	·88d.	·85d.	·85d.	·97d.	1·13d.

It will be seen that there was a marked reduction in the average price for lighting and heating from 1914 to 1916, and the present price is lower than in 1915; power charges also fell somewhat, but now exceed the pre-war average. The over-all average price, however, has fallen by 21 per cent., and an analysis of the figures indicates that the power output in 1914 was 3·5 times the lighting and heating output, whereas in 1918 the ratio was no less than 16 : 1.

The tariff which is in force is given briefly below:—Lighting, 4d. per unit, or 4d. per unit less 50 per cent., subject to a minimum payment representing 4½ hours' use per day, for 365 days a year, of the maximum number of lamps in use at one time; domestic rate, all purposes, 10 per cent. per annum on the net assessment, plus ½d. per unit; outside lighting, 2d. per unit; picture theatres, 3½d. per unit for lighting, 1½d. per unit for lanterns or power; works lighting, 1d. per unit, subject to an agreement; heating, 1d. or ½d., subject to minimum payment; power, according to mode of use, 2d., 1½d., or 1½d. (continuous working), up to 13·7 units per day, with discounts up to 40 per cent. for 205½·7 units per day.

An alternative charge for power of £4 per K.V.A. of maximum demand, plus ½d. per unit, is offered for high-pressure supply in bulk. It is interesting to note that electric furnaces are charged at the power rate. The tariff was increased in 1916 and 1917 by the addition of 10 per cent. to charges over 2d. per unit and 33⅓ per cent. to charges of 2d. and under; and from September last the latter increase was raised to 45 per cent.

In addition to the supply undertaking, the department carries on a considerable contracting business, the accounts of which are kept distinct from those of the supply; in 1917-18 the revenue of this branch was £47,923, and the working expenses were £44,393. The department was responsible for the installation of 6,356 H.P. of motors, out of a total of 18,291 H.P. connected during the year.

The diagram on page 33 (fig. 16) shows graphically the progress made by the undertaking during the six years which have elapsed since we last gave details of its progress; it will be seen that development has taken place at a phenomenal rate. Throughout the whole of the proceedings connected with the work of the extensions, the Electricity Supply Committee showed that it was fully alive to the urgency of the situation, and never hesitated to depart from official procedure in the interests of the undertaking and to meet the national interests, whenever it was necessary to do so, and allowed the engineer to carry on unencumbered by a too close regard for adherence to rigid regulations, which may be very necessary under peace conditions, but at times of emergency often have a retarding influence, with no compensating advantage. We trust that the city will continue to advance, and that the electricity supply department will both contribute to, and share in, its prosperity.

A total of 194 employés left the department for service with His Majesty's Forces, of whom 21 have been definitely reported killed.

In conclusion, we must express our thanks to Mr. S. E. Fedden, engineer and general manager of the undertaking, for facilities for preparing this article, to Mr. H. E. Yerbury, deputy general manager, Mr. Cuthill, assistant engineer, Mr. Taylor, constructional engineer, and to all the members of the staff, who most courteously afforded us assistance and information.

ELECTRIC FURNACES IN THE NORTH OF SPAIN.

[BY OUR SPECIAL CORRESPONDENT IN SPAIN.]

A COMPANY (Altos Hornos de Vizcaya) has recently installed an electric furnace in its works at Baracaldo, near Bilbao, for the production of specially refined steel. The furnace is of the "Electro-Metals" type, producing 2½ tons of steel at each charge. The plant has been running experimentally for some months, but the staff is now conversant with its working, and is operating the furnace continuously when the supply of materials will allow of it.

Three-phase current is supplied by the Sestao power house, and is transformed to two-phase by means of two transformers coupled up in "Scott" connection.

The furnace is built of refractory brick strengthened on the exterior by steel slabs. The furnace bottom is of calcined and crushed dolomite. Two charging doors and one tapping hole are provided. The furnace crown, in the form of an arch, is of one piece of steel with a brick lining. The whole furnace is mounted on trunnions, and tilted by means of an electric motor.

The working pressure is 70 volts. The arc is struck by hand, and hand regulation is continued for some minutes, when the automatic regulator is put into service. The average consumption of energy works out at 450 KW.-hours per ton of steel obtained, but it is hoped to reduce this figure as the staff gets better acquainted with the peculiarities of the plant. A complete operation of the plant takes about four hours. The best record has been seven charges in 24 hours—17½ tons of steel.

Up to the middle of September nearly 300 tons of fine steel had been produced, in spite of great difficulties in obtaining materials of good quality. Occasional lack of coal at the generating station was also a drawback. It is hoped that the return to normal times will enable the furnace to be run continuously during the coming year.

There are one or two other electric furnaces now being established in the North of Spain. Messrs. F. Echevarria and Sons, of Bilbao, have under construction an Héroult furnace of five-ton capacity at their Recalde ironworks. Current will be supplied by the Sociedad Hidroelectrica, of Bilbao. A small American furnace is also working in Pasajes (Guipuzcoa), and another in Araya (Alava). Another electric furnace for the production of ferro-manganese is being erected in the province of Teruel.

German Organisation of Technical Experts.—The German Economic Union and the Society of German Certificated Engineers have together formed a working association of economic and technical experts. The extent of the objects of the new society, in so far as these are of general interest, is not known. All persons with technical knowledge and experience have been called upon by the society to devote their services to the best advantage of the community under the present changed conditions.—*Soziale Praxis*, November 28th.

WHAT IS MEANT BY EFFICIENCY METHODS?

By E. A. Pells, Major, R.E.

Efficiency is a frightful bogey word, and certainly does not mean "slavery," as I once heard a labour agitator say, for "slavery," in the sense of the word as he meant it, is most inefficient. It means, on the contrary, the maximum result with the minimum of effort.

Some years ago, F. Winslow Taylor, an expert American engineer, began to study the expenditure of effort which is designated "work." He carefully studied the amount of effort a man had to put into his work, and the time he spent on each separate action; after which, he studied each individual movement, and by careful arrangement of the appliances the worker had to use in his work and a careful training of the worker to eliminate all waste movement, he was able to increase the productive value of the worker by from 25 to 50 per cent.

Now, this sounds all very well from the general standpoint; but one will ask, how did the employé get on? Supposing each operative increases the amount of work he does by 50 per cent., which is half as much again, then for every three men that were employed before, one is dispensed with and thrown out of work.

Let me answer the question in parts. First, the employé gets practically the whole of the extra value of the increased output, for the employer gets his reward in the added efficiency of his plant, although he must have a margin to cover the extra depreciation which usually follows a "speed up." Secondly, the worker does *not work* any harder—that is, he does not make any greater effort than before; but the difference is, that the whole of his effort is a useful one—all due to the new methods taught him by the efficiency engineer. So it is not 50 per cent. extra work—it is 50 per cent. extra result from the same amount of work. In fact, instances have occurred where output has been increased by 30 per cent., hours reduced by 12 per cent., and wages increased 15 per cent., which, considered carefully, shows a great advantage on the side of the operative. Thirdly, in all cases where "scientific management" or "efficiency methods" have been introduced under the "Taylor System" that have come under my purview, never in a single instance has any employé had to be dispensed with, and a very little thought will indicate the reason. The increased productivity at reduced cost which the employer enjoys enables him to compete in the world's markets very successfully, and demands increase so rapidly that he is enabled to extend his works and increase, instead of decrease, the number of workers he employs.

There is a further interesting point arising out of this which I should like to bring forward. Presuming that these methods are introduced into the whole of the industries in a particular country, the manufacturers of that country could then undersell all comers in their home markets, and foreign competition would not bother them. On the top of this, the purchasing value of the workers' wage would be greater, and an era of prosperity would exist such as never existed before.

But, one will say, surely the employer, when he finds out what a fine thing the worker is making of it all, will want to reduce wages; he will find reasons for this which will appear plausible, and then down goes the pay.

And! my reply will be, down goes the employer who could show such a lamentable lack of knowledge of human nature. Cutting in rates is one thing that the efficiency engineer will never agree to. I know that in the old days, happily gone beyond recall, the usual way a manufacturer would economise was by cutting his wages bill, and consequently cutting the throat of the goose that laid the golden eggs, for one seldom finds that such methods have met with success. They have, however, given us a perpetual mistrust of Capital, as such, and it is a recognised axiom in Trade-Union circles that the interests of Capital and Labour are diametrically opposed. This, I contend, is a complete fallacy, and but a very little study will prove it such. The fact is indisputable, that we all depend upon the success of the country's industries to a greater or lesser extent, and the individual can only be truly prosperous if the country is also. Therefore, it is obvious that anything that tends to promote that prosperity must also promote the prosperity of the individual, thus clearly showing that "Scientific Management" properly applied must make for the ultimate good of both employer and employé; and whilst it is bringing them prosperity, so it is bringing prosperity to the country they live in.

It may be asked, now, why is it necessary to make time studies, motion studies, and put in a system which appears to be very elaborate to achieve all this; surely this could be attained without a lot of elaboration? There is raised a very interesting point. It will have been noticed that games requiring skill of any kind require a certain amount of practice and careful coaching by those who know the best way of doing these things. What do we say when we see a man on the football field who apparently has no idea of the game? It, of course, depends a great deal on our capacity for sarcasm or the extent of our vocabulary. We expect the men to be carefully trained and taught their places in the team. In all other kinds of sport we expect the same thing, and object loudly and strenuously if it is not so; yet we often place a completely untrained man in a workshop or on a job, and expect good results. "Scientific management" wants to alter all this; and by carefully studying the methods and times of the best workers, we can arrive at what is, one might say, "championship form." Then, by carefully teaching each of the other operatives these methods, we must ultimately greatly improve the general work of the shop or factory as a whole. Certainly it may be seldom that any of the men really approach "championship form," but when they do why shouldn't they reap the benefit? Why should they be prevented from getting the real value of their talents just because they lie in the paths of industry instead of those of sport? If a man is an expert in any kind of sport he can make a fairly good thing out of it. Then let us bring the same kind of feeling into industry; and where a man is head and shoulders above his fellows, let him reap the benefit. The idea of the efficiency engineer is to put such a man in as a coach or instructor of the best methods, and surely this is a good idea. When doing this, we do not just let the man be made a foreman. That may entail a higher standard of education than your wonderfully skilled manual worker possesses; so, therefore, it is unfair to him. Make it an entirely separate job, and then see how soon he will justify his existence. Even if your best workmen do not desire to act in this capacity, they must reap the full benefit of their extra proficiency in larger wages, which will bring in its train a higher standard of self-respect, better housing, and happier home conditions.

A question may arise, what becomes of the dullard? My answer is, there are no dullards; there are lots of square pegs in round holes, and the effect of "scientific management" is to find all the right holes for the right pegs. I remember one instance of a man being sacked from job after job as absolutely useless and a fool, and yet that man finally became a skilled horse-keeper, and the veterinary surgeon who employed him valued him most highly. It was just the question of finding the right place for him.

There is a place in the world of industry where the great utility of "scientific management" will prove itself in time; by collecting and collating data it will be the means of placing many workers in occupations where they can realise a comfortable competency, instead of always grovelling along as "weaker brothers" all their lives.

Finally, the ability of a community to pay high wages depends more upon the avoidance of waste than upon increase of accumulations. The avoidance of waste in operative effort, time and fatigue, and employer's materials and power, means prosperity for the employé, employer, and the Empire.

Tradesmen Using the Royal Arms.—The *London Gazette* for January 3rd contains lists of tradesmen in London and elsewhere who hold warrants of appointment to Royalty, with authority to use the Royal Arms. These lists, as we suggested some years ago in connection with certain great public celebrations, should be of service to firms who will make a speciality of electrical illumination and device work when Peace rejoicings take place in a few months' time.

ELECTRICITY IN AGRICULTURE.

SEVERAL schemes for electric ploughing have recently been tried, but each system seems to have been designed with the idea that the sole object to be accomplished is to secure a sufficient pull on the plough, and, except that the steam engine is replaced by an electric motor, they differ very little from the Fowler system.

In applying electricity to agriculture it should be remembered that the main object is agriculture, and not merely the application of electricity, and that a first essential is good drainage.

An interesting system devised by Mr. G. F. COOKE, and described in patent specification No. 114,109, consists of elevated rail tracks which are permanently erected parallel to each other on opposite sides of the area to be cultivated, the tracks being designed to carry travelling electric motors, by which all the necessary hauling operations can be performed, from the draining and ploughing of the soil to the harvesting and transportation of the produce.

These tracks serve three distinct purposes: first, they form the main drains; secondly, supports for the travelling motors; and thirdly, a light railway, by means of which the seed and fertilisers may be carried to the soil and the crops transported; they also, incidentally, serve to divide the land into suitable areas, so that waste of land for hedges, ditches, and roads is rendered unnecessary. The distance between the tracks may be as great as half a mile, but, wherever possible, this distance should be uniform. Where the land is slightly undulatory, the level of the track may be preserved by making the supports longer or shorter, as the case may be.

The track consists of two steel rails, L shape in section,

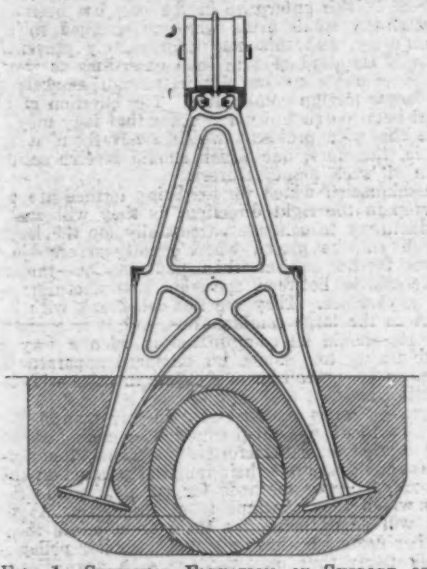


FIG. 1.—SECTIONAL ELEVATION OF SUPPORT OF RAIL TRACK, AND CONCRETE DRAIN.

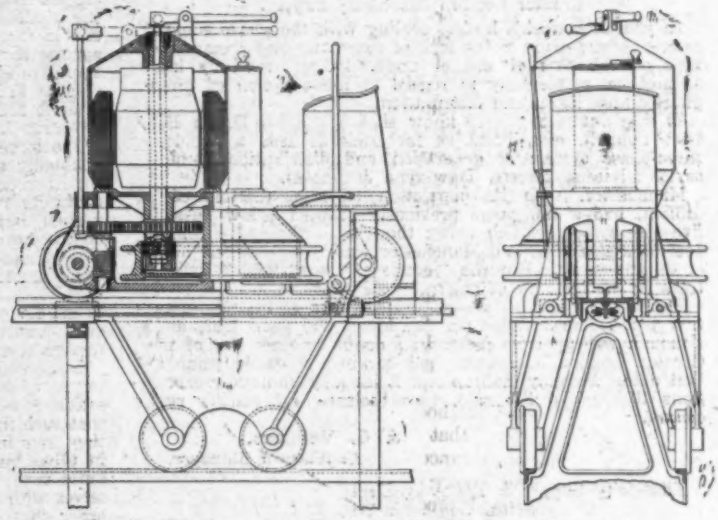


FIG. 2.—SECTIONAL SIDE VIEW AND END VIEW OF TRAVELLER.

which are secured to the upper ends of A-shaped supports, preferably steel or ferro-concrete castings; the lower ends are buried in a suitable foundation, which also forms the main drain; two lighter rails are secured to the supports near the ground—these serve to maintain the vertical position of the traveller. The supports project about 4 ft. above the surface of the ground, and the track rails are so secured to them that a slot is left between the rails, through which a collector projects on to two conductor rails, which are mounted on suitable insulators inside the track rails.

Each track serves both as a horizontal and lateral support for an electrically-driven winding drum, which is arranged to travel along the rail as the cultivation proceeds, and is also provided with a brake by means of which it is locked to the rails during the hauling operations.

The implements are hauled by means of a wire rope, which is slightly longer than twice the distance between the tracks, the two ends of the rope being secured to the implement, whilst the rope itself is carried across the field and coiled two and a half times round each winding drum. By this means the necessity of coiling the cable evenly on to the drums is eliminated, whilst, it is claimed, securing a much higher and more uniform hauling speed and longer life of the rope. The power is also applied at two points of the cable simultaneously, thereby securing a 50 per cent. higher power factor than where one engine is idle half the time, as well as making a lighter system possible. All the implements are double-ended, i.e., capable of working whilst travelling in either direction, and as they can be hauled right up to the tracks, there is no time lost in turning, and no subsequent finishing of wide headlands is necessary.

The total weight pressing on the land is that of the implement only, and there is no setting or removing of tackle, and no cartage of fuel or water.

Either D.C. or A.C. may be used, and where D.C. is available it may be supplied to the rails direct, if their total length does not exceed one or two miles. If the total length of rail is long, or the current heavy, it may be supplied by means of an insulated cable; the rails are divided into sections and connected to the cable as required, suitable switch boxes being arranged in the rail supports. The current would be supplied at about 500 volts pressure, series motors being used, controlled by ordinary tramway-type controllers and resistances.

Where the total length of rail is very great and the load extremely heavy, single-phase alternating current has several advantages. An insulated high-tension cable can be carried inside the supports, from which tappings may be taken at suitable intervals to step-down transformers which reduce the pressure to about 350 volts, at which pressure it is fed to the conductor rails. With this system, single-phase commutator motors would be necessary, controlled by tramway-type controllers and auto-transformers.

The three-phase system has similar advantages to the single-phase system from the point of view of transmission over long distances, but requires at least two conductor rails and an earth return, and two sets of insulators.

The greatest advantage claimed for this system of elevated-rail tracks is that its installation would lead to the establishment of agriculture on a more permanent, as well as a more intensive, basis, as not only is the application of electricity to the machinery of agriculture made most easy, but the system provides at the same time a permanent means of soil drainage and of transporting the produce.

The drainage of the soil can be quite easily effected by means of a mole draining machine, hauled from the track by the same motors as used for hauling the plough, the concrete main drain being provided with suitable branch drains into which the mole drains can discharge.

Most of our agricultural districts are within 10 miles of a railway, but the annual cost of the necessary cartage almost equals that of ploughing, and any system which offers facilities in more than one direction must of necessity cost less than a single purpose scheme. Several schemes for the construction of light railways for agricultural produce have been promoted, but the chief obstacle appears to be the cost, and only some 500 miles have been so far constructed, at a cost of £7,000 per mile.

Assuming the cost of constructing the elevated rail tracks to be the same, viz., £7,000 per mile, this gives the cost per acre at about £30, for which sum the land is not only drained, but hedges, ditches, and roads, and the cost of their maintenance, are eliminated, while the advantages of cheap power are made available at all times, and several alternative routes provided for transport.

We understand that a company, named Electroculture, Ltd., is being formed to operate the patent, and hopes to have tracks ready shortly for demonstration.

Dielectric Loss in Cable.—An instance is cited in the *Electrical Review*, of Chicago, of very long 20,000-volt underground cables breaking down repeatedly, even when the kilovolt-ampere load was quite insufficient to cause overheating. It was noticed that the line broke down after it had been in service for a certain time, almost irrespective of load. The cause of failure was cumulative heating due to dielectric losses and consequent reduction of dielectric strength. By cutting pressure off the line at intervals so as to prevent cumulative heating, the number of breakdowns was reduced by 75 per cent.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Pressure Regulators.

I should be greatly obliged if any of your readers could give me their views on the question of the installation of electric pressure regulators.

The purpose for which I require a regulator is to regulate the running of an installation driven by a water turbine that is also fitted with a governor, but I need hardly point out to many users of this type of apparatus that even the very best of water-turbine governors are not very quick in action, so that as absolutely accurate running is desired, some additional form of electric governor must be installed. Most of the apparatus offered for this purpose appears to be at an extremely high price, but even this is not very important provided they carry out what is claimed for them.

In speaking of the question of the regulation of the speed of a governed water turbine, I am not, of course, alluding to the question of turbines operating under very high heads, as naturally a turbine that is governed by deflecting the jet that is working at high pressure will, of course, govern accurately, but in the turbine under discussion the head is small, and therefore the regulation is slow-acting. I shall be glad to be favoured with other firms' experience with the use of electric pressure governors under similar conditions.

Engineer.

January 2nd, 1919.

Greater London Electricity Supply.

In your last week's leader, dealing with the above subject, reference was made to the lack of enterprise and progressiveness on the part of smaller undertakings owned by local authorities, particularly in regard to the adoption of three-phase transmission and distribution.

It may interest you to know that the Erith Urban District Council, established as far back as 1903 a standard three-phase system of generation and distribution (professional advisers, Messrs. Hawtayne & Zeden).

Manchester, with its population of three-quarters of a million, had a few years previously adopted a low-pressure five-wire system, which many thought in those days might become a standard, and Manchester was always rather proud of its enterprise. But the "battle of the systems" will be fresh in the memory of most of your readers.

Again, in regard to steam turbines, the Halifax Corporation had steam turbines in use about the year 1897, and, although writing from memory, I doubt whether any of the Greater London companies had turbines installed prior to that date. Possibly Halifax and Erith may be merely exceptions that prove the rule, nevertheless—*Fiat justitia ruat cælum.*

J. C. Williams,
Engineer & Manager.

Electricity Supply & Tramway Dept.,
Erith, *December 31st*, 1918.

[We refer to this subject in our leading columns.—Eds. Elec. Rev.]

British Fair Play?

As the I.M.E.A., to which my Committee belongs, expressed the opinion that chief technical officers should not be members of the E.P.E.A., I sent in my resignation of membership of that Association. Later, at another meeting of the I.M.E.A., the following resolution was proposed, seconded, and carried unanimously:—

"That, in the opinion of this Association, the higher officials employed in municipal electrical undertakings should have an increase in salary at least equivalent to the war awards."

Municipal Electricity Committee members only took part in the discussion and voting. When this recommendation came before my Committee, they, knowing that I had resigned my membership of the E.P.E.A., turned it down, although at the same meeting they offered an increase to members of the staff belonging to the E.P.E.A., and the workmen belonging to the E.T.U. This shows the sort of consideration we get if we do not belong to a strong association. For myself, as I thought that "Sauce for the goose should be sauce for the gander," I immediately withdrew my resignation from the E.P.E.A., and propose to continue as a member until an association is formed which can enforce the rights of the chief technical officers, although it is rather awkward for the chief (however much he may sympathise with them) to belong to the same association as the staff, but at present he apparently has no other alternative.

It is this sort of unfair treatment on the part of employers which absolutely forces their staff and men to join protective associations.

Borough Electrical Engineer.

January 6th, 1919.

The Future of the Shiftman.

I cannot but view with alarm the apathy of shiftmen over the problems involved in the matter of reconstruction; whilst other employés are gaining material advantages, the shiftman is left practically in his old position.

I cannot understand the action of the Electrical Trades Union, the National Union of Enginemen and Firemen, and the Workers' Union in accepting a 56-hour week for shiftmen, whilst applying for a 47-hour week for other employés; surely they cannot be voicing the views of shiftmen, who for years have been working a 56-hour week. I should think the time is now ripe for a universal 47-hour week.

Undoubtedly the shiftmen are not so well organised as they might be owing to the fact that they are distributed over the country, and are attached to several different trade unions, which do not, apparently, thoroughly understand the individual situation.

Cannot something be done to bring these men into closer unity, and so bring their grievances before the committee set up to inquire into the conditions that prevail, and to see that these men get their due in any reforms that are to be made in the matter of reconstruction?

A Shiftworker.

January 4th, 1919.

The Need for Co-operation Among the Smaller Manufacturers.

I have read with great interest your leader in your first issue for this year, and think you have touched on a subject which is of primary interest and importance to the British electrical industry.

The feature of British enterprise in the past has been the number of relatively small firms who are engaged in the engineering industry, and this has unfortunately prevented the production of standard gear in such quantities as would enable them to compete successfully in foreign markets as against their larger foreign competitors. The question of co-operative effort between such firms in order that they may be able to tackle the wide problems which await them at the present time is, therefore, one which should receive serious attention from all such manufacturers.

The large combination which we see being formed are undoubtedly a step in the right direction, as they will enable British manufacturers to compete successfully for the larger contracts which will be placed when conditions are again normal, but the further subject which you mention—that is, of co-operative efforts between specialist manufacturers—is also of equal importance. They are not concerned with the same problems as the large combinations, but it is essential that their efforts should be co-ordinated in such a way as to enable each maker to produce his standard apparatus in such quantities as to enable him to compete in price with his foreign competitors.

Successful production is the first step in any manufacturing industry, as without efficient production no selling organisation can be carried on satisfactorily. It seems, therefore, that such firms should so limit their range of production that they can introduce proper methods for quantity production in those lines which they continue to manufacture. At the same time, it will be necessary for them to associate themselves with other firms who have adopted a similar policy in order that collectively they may produce such quantities of each class manufactured that the cost is brought down to meet the international competition.

What, I think, is required, is some means of intense specialisation with regard to production, and a collective effort as regards the selling. Specialisation in production necessitates joint organisation for selling, because it is necessary for any sales organisation to have command of a complete range of apparatus in order to be successful.

It is for these reasons that I welcome the publicity which you have given to this matter as your New Year's message, and as one particularly interested in the success of small specialists' manufactures, I trust that the subject may be taken up by British manufacturers to see what steps can be taken with a view to their associating together to carry out the object you have outlined.

H. C. Siddeley.

London, W.C. 2, *January 7th*, 1919.

Electrostatic Dust Precipitation.—In an article on this subject *Industrial Management* says that a copper-smelting company installed a precipitating plant at a cost of $113,900. The operating expenses (power, labour, supplies, &c.) were $14,600 a year; but the value of the copper dust collected was $180,018 a year (all figures based on pre-war prices). Cement plants can also show a good return even on such low-value material as raw cement dust, but of special importance is the fact that many cement plants can collect many tons of potash per annum, which is valuable at all times, and immensely so at present. One cement plant, with a precipitating equipment that cost $180,000 to install and $10,395 a year to operate, obtained recoveries of cement dust worth $25,000, and potash worth $50,000 a year (also pre-war prices).

ADMIRALTY ELECTRICAL ENGINEERING STAFF DINNER.

Presentation to Mr. Wordingham.

At Cannon Street Hotel, London, on the 2nd inst., the Admiralty Electrical Engineering Staff gave a complimentary dinner and presentation to Mr. C. H. Wordingham, C.B.E., M.Inst.C.E. (President of the Institution of Electrical Engineers), on his relinquishing the office of Director of Electrical Engineering, Admiralty. As already announced in these columns, Mr. Wordingham has resigned the directorship in order to resume practice as a consulting engineer, but has been retained by the Board of Admiralty in a consulting capacity.

At the request of the staff, Mr. Wordingham presided over the festivities, and the proceedings were graced by the presence of Mrs. Wordingham. The company numbered upwards of 200, including Mr. A. D. Constable (Assistant Director of Electrical Engineering, now acting in charge of the Department), Mrs. Constable, Mr. E. T. Williams, Mr. W. McClelland, Mr. L. J. Steele, Mr. Z. Kingdon, Mr. Hunt, Mr. R. Wightman, Mr. F. Purser Fletcher, Mr. F. C. Forster, Mr. W. P. Scott, Mr Melville Ackery, Mr. Frank Morton, Mr. R. W. Willis, Mr. Uttley, Mr. E. E. Rogers, Mr. H. R. Green, Mr. J. Shaw, &c.

Proposing the health of Mr. Wordingham, Mr. Constable reviewed the progress of the Department during the past 15½ years, remarking that Mr. Wordingham had completely revolutionised the electrical equipment of the Navy, which was unequalled in any navy in the world, and had helped the Navy to carry through the recent supreme test without any serious breakdown. When Mr. Wordingham first joined the Admiralty service, he had only two assistants, both of whom were present that evening, and now the staff numbered something like 200 of all ranks. Mr. Wordingham was possessed of extraordinary energy, but for which he could not have accomplished half of what he had done for the Navy. He had been associated with Mr. Wordingham closely at the Admiralty for six years, and could testify to his straightforwardness of character, honesty of purpose, and genuine sympathy with the members of his staff, and all who came to him for a helping hand. Voicing the feelings of the whole of the staff, he said they regretted exceedingly Mr. Wordingham's departure, thanked him for his unfailing courtesy and consideration to them, and wished him long life, happiness, and the success which he deserved. In conclusion, he asked Mr. Wordingham's acceptance of a presentation (a handsome gold watch, together with a framed photograph of the staff and an illuminated album containing the autographs of the subscribers) as a small token of the esteem and affection in which he was held by the entire staff, and as a memento of the Department and of the work done by him at the Admiralty.

In acknowledging the gift, Mr. Wordingham said he would always treasure it with affection as well as gratitude. Mr. Constable had referred to the fact that 15½ years ago, when he was practising as a consulting engineer, he was invited by the Admiralty to take charge of the Electrical Department then being formed. There had just been presented a report by a committee on the electrical working of plant and gear in His Majesty's ships, and that report was intended to be the basis of the work of the new department. He found that report exceedingly useful; when it happened to tally with what he wanted to do he referred to the report, and whenever he did not want to do what the report said, he left it severely alone! In the early days, in order that the official trials of a ship might be passed it was necessary to eviscerate the electrical gear and put it into an oven. If a test was made, say, within 12 hours, the test was satisfactory and the gear passed; if they waited too long they had to do it all over again. Obviously one of the first things he had to do, therefore, was to get rid of insulating material that would absorb water. When he entered the service one of the chief materials in use was "Ambroin"; he had made the acquaintance of that German material before, and he knew it to be the very worst of its kind in existence. "My feelings towards the Germans then," he continued, "were the same as now, and I was quite determined that Ambroin was going, and it went very quickly. It was thoroughly bad, and it was being used in a thoroughly bad way. Contractors were complaining bitterly of the high prices which they had to pay the Germans for that insulating material for use on H.M. ships. There is no Ambroin in use now in the Navy, and there has not been any used for a great number of years." Practically none of the standard cables in those early days had wires in stranding numbers, and there were a very large number of cables to cover a comparatively small range. He introduced standard sizes of cable and standard stranding numbers, but he was told that his new cables would be so stiff that it would be impossible to put them into the ships. He did not agree; those cables were made, and he did not think anybody ever found out the difference. They had ordinary commercial standard cables instead of the old-fashioned ones! As the work grew, it very soon became evident that they had too many cables, and that if they wanted to go along on the old system they would have to enlarge the ships in order to get the cables through the bulkheads. That led on to the ring-main system, about which there had been a good deal of controversy, but which still survived, and which had survived the actions that had been fought in the great war. His experience was based upon work on a large scale, and he was accustomed to heavy underground paper-insulated cables. He had abandoned rubber as being anathema altogether. So when the ring-main system of distribution came in, he ventured to introduce armoured paper-insulated cables. Again he was told that he knew nothing about ships, and that it was quite impossible to get these underground mains into use—but they went there all the same, and it was an interesting fact that from the time the first ring-main paper-insulated cables were put in to this day, so far as he knew, there had never been a fault on them. The first thing which struck one was that the Admiralty as a whole, including shipbuilding firms, possessed all the attributes of "mass." It was a terrific task to alter anything which was already in motion, and it was a terrific task to start this mass moving. That was good in itself, because it prevented violent fluctuations, but it was a frightful job to get any reforms made when those reforms were needed. Then, again, one was impressed by the hugeness of the Admiralty machine, and the marvellous organisation which knit together all the several departments and ensured that the work which affected a number of departments was dealt with by them, and that all those who should know did know what was going on. He had nothing but admiration for the way in which this extraordinarily difficult matter had been worked out. The Admiralty Contract Department was a model for every Government Department to copy. Concluding, Mr. Wordingham proposed the toast of "The Admiralty Staff," coupled with the name of Mr. E. T. Williams (Assistant Director of Electrical Engineering), who responded in a few well-chosen sentences.

TRADE STATISTICS OF NEWFOUNDLAND.

The following figures, showing the imports into Newfoundland during 1916-17 of goods which are of interest to electrical contractors, are extracted from the recently-issued trade statistics. The figures for 1915-16 are added for purposes of comparison, and notes are given of any increases or decreases.

	1915-16. Dols.	1916-17. Dols.	Inc. or dec. Dols.
Radiators, electric light material, &c.—			
From United Kingdom ...	1,000	1,000	—
,, Canada	10,000	20,000	+ 10,000
,, United States ...	36,000	89,000	+ 53,000
,, Other countries ...	—	1,000	+ 1,000
Total	47,000	111,000	+ 64,000
Machinery for mining purposes.—			
From United Kingdom ...	1,000	55,000	+ 54,000
,, Canada	2,000	265,000	+ 263,000
,, United States ...	2,000	69,000	+ 67,000
Total	5,000	389,000	+ 384,000
Constructional material and machinery for local industries.—			
From United Kingdom ...	1,000	2,000	+ 1,000
,, Canada	7,000	18,000	+ 11,000
,, United States ...	16,000	257,000	+ 241,000
,, Other countries ...	—	2,000	+ 2,000
Total	24,000	279,000	+ 255,000
Oils, lubricating.—			
From United Kingdom ...	2,000	1,000	- 1,000
,, Canada	9,000	7,000	- 2,000
,, United States ...	58,000	33,000	- 25,000
Total	69,000	41,000	- 28,000
Materials for Western Union Telegraph Co.—			
From United Kingdom ...	7,000	1,000	- 6,000
,, United States ...	6,000	6,000	—
,, Canada	3,000	—	- 3,000
Total	16,000	7,000	- 9,000
Goods for Anglo-American Telegraph Co.—			
From United Kingdom ...	1,000	500	- 500
,, United States ...	2,000	2,500	+ 500
,, Canada	—	500	+ 500
Total	3,000	3,500	+ 500
Materials for wireless telegraphy.—			
From Canada	5,000	9,000	+ 4,000
,, United States ...	—	3,000	+ 3,000
Total	5,000	12,000	+ 7,000

Dollar = 4s. 2d.

BUSINESS NOTES.

New French Company.—La Société le Matériel Général Electrique M.G.E. is the name of a new company which has lately been formed in Paris (15, Rue des Petits Hotels), with a capital of £19,200, to carry on an electrical engineering business.

Social.—"To mark the termination of the war," the directors of the ROCHDALE ELECTRIC CO., LTD., electrical engineers, Shawclough, Rochdale, entertained their employés to supper on Friday. About 80 guests were present. A whist drive preceded the supper, and dancing followed. Mr. Walter Scott, chairman of directors, presided, and the speakers included Mr. W. D. Watson, managing director, Mr. W. L. Ashworth, manager, and Mr. Henderson, secretary.

Fire.—On the evening of January 1st fire broke out at the works of Messrs. Barraclough Bros., electrical engineers, Perseverance Works, Brighouse, cables being burnt.

The American Bosch Magneto Co.—The works and business of the American Bosch Co., at Springfield, Mass., which since May last have been in the hands of the U.S. Alien Property Custodian, were recently put up for sale by auction. There were five bidders for the property, which was eventually secured for the sum of £830,900 by Mr. H. C. Griffiths, of New York. The purchaser, who is reported to have bought entirely on his own account, is stated to have made a good bargain, a conservative and unofficial estimate of the value of the concern and its assets being one million sterling.

New Osram Company Formed at Berlin.—The *D.A.Z.*, November 22nd, stated that the Osram Co., Ltd., had been registered, with premises at Berlin, and a capital of Mk. 300,000, for the purpose of manufacturing electric bulbs especially with the Osram trade-mark, and other electrotechnical articles.

German War Profits.—German industrial companies may yet come to feel that it would have been better for them if they had had to pay Excess Profits taxes, as have British manufacturers. The *Kölnische Zeitung* of November 26th stated that the People's Marine Council was demanding an explanation from the Government about the dealings of the "Z.E.G." (Central Purchasing Association), which had made enormous profits unlawfully at the expense of the nation. The *Kölnische Zeitung* strongly advocated the holding of an inquiry, and the compulsory publication by the Z.E.G. of its profit and loss account and balance-sheet.

Export Restrictions Removed.—The *London Gazette* for January 3rd contains a further list of relaxations in export prohibitions.

Trading with the Enemy.—The *London Gazette* for January 3rd contains a further list of persons and bodies abroad with whom trading is prohibited, or whose names have now been removed from the list.

A Novel Lighting Fitting.—With reference to this device, which we illustrated last week, we understand that the fitting was designed and manufactured by MESSRS. W. LUCY & CO., LTD., of Oxford, who exported it to South Africa. This method of spring suspension of the lampholder has also been used by the Wardle Engineering Co., Ltd., of Manchester, in its "Beatark" fittings, and has proved very satisfactory. The company now uses a specially designed shade ring-type porcelain lampholder in a metal disk.

Catalogues wanted for Belgium.—Mr. A. Collumbien, of 2, Woodlands Road, Cheetham Hill, Manchester, who is shortly starting electrical business in Belgium, desires to receive catalogues and price lists.

American Engineers and French Reconstruction.—The arrival in Paris of a mission of American engineers to confer with French engineers on the subject of reconstruction is announced in the French Press. This mission includes delegates of the United States Society of Civil Engineers, the Society of Mechanical Engineers, the Electrical Institute, and the Institute of Mines. The Mission is to visit the liberated areas, and will work in five sections, as under:—

1. Port and canal improvements.
2. Reconstruction of roads.
3. Agriculture.
4. Utilisation of water-power resources.
5. Technical education.

—*Board of Trade Journal.*

Platinum in Spain.—Platinum to the extent of from 2 to 3 grammes per metre has been verified to exist in the Serrania de Ronda, as the result of three years of exploration conducted at the instance of the Spanish Government. The Serrania is an eruptive volcanic range, 1,400 sq. km. in extent, which thus far outstrips the platinum fields of the Ural Mountains, which are only 50 sq. km. in extent, have never yielded more than ¼ gramme per metre, and is tending to exhaustion.

Football Notes.—The return match between the Magnet F.C. and the Waygood F.C. was played on Saturday last, and resulted in a win for the former by 6 goals to 2. For the winners Dyke scored three goals, but the ground was so bad that most of the players covered themselves more with mud than with glory.

The Federation of British Industries.—From the *Bulletin* of the F.B.I. for January 2nd, we note that the total membership of the Federation is now as follows:—163 Trade Associations, 15 Associations of controlled establishments, and 822 firms, making a total of 1,000.

Lantern Slides.—Referring to our inquiry for lantern slides for the instruction of Army men, Messrs. Newton & Co., of 37, King Street, Covent Garden, W.C. 2, inform us that they are making preparations for the immediate production of lantern lecture sets on the general subject of engineering, and have obtained permission to reproduce photographs from well-known firms for this purpose. They send us a copy of their "Catalogue of Lantern Slides," Part II, which gives particulars of many thousands of slides dealing with educational and scientific subjects, but does not include the sets above mentioned.

Rationing Committee Disbanded.—With the general release from Government control of raw material used in industry, the necessity for rationing disappears, and the Civil Industries Committee through which that rationing has been exercised is now to be disbanded. The Committee was appointed by Dr. Addison, then Minister of Munitions, in February, 1917, under the name of the Priority Advisory Committee. Its duties were to investigate the claims of industries threatened with hardship or extinction owing to the shortage of raw materials, and to make arrangements whereby they might at least be kept alive, even if not maintained at their former level. The Committee comprised some departmental officials, but was composed mainly of business men. The chairman was Mr. John Wormald, of Mather & Platt, Ltd., engineers, Manchester.

In accord with the Controller of Priority, the Committee from the beginning undertook the rationing of manufacturers already grouped together in trade associations or capable of being grouped. It investigated the affairs of 91 trades, in 78 of which a rationing system was established. In addition, the Committee from time to time, by arrangements with the Minister of Reconstruction, investigated claims made to him for materials, plant, and machinery required in preparation for the resumption of peace-time work or for the starting of new industries. We understand that from the outset the Committee worked on the principle of winning the co-operation of the traders themselves. No decisions were made without consultation with representatives of the industries concerned, and the meetings between the two sides were full and frank. The Committee originated the system of appointing, as official rationing authorities, independent persons of high standing, chiefly firms of chartered accountants. This system is understood to have worked to the general satisfaction of the traders rationed. To ensure that the supplies of raw materials should be forthcoming, the Committee worked in closest touch with various Government Departments; a close liaison has also been maintained with the War Trade Department for the purpose of correlating manufacture to export. The Committee has met for almost two years twice a week regularly, and in its earlier months three times a week. The chairman, Mr. Wormald, has given the whole of his time to the work, assisted by Mr. Frederick Simmons, and by Miss Fraser as secretary, with no other staff. For its services the Committee has been warmly thanked, not only by the Government, but also by the traders whom it rationed. It is generally considered that this Committee has furnished a striking example of what can be effected in administration by appointing one man of experience and of approved business ability and by allowing him to select his own colleagues.

Catalogues and Lists.—THE EQUIPMENT AND ENGINEERING CO., 2 and 3, Norfolk Street, Strand, London, W.C. 2.—Catalogue, consisting of several illustrated lists giving descriptive particulars of the E. and E. electric arc welding plant and the scope of its repair work, the E. and E. magnetic system of electric arc welding, and details and prices of arc welding accessories and operators' sundries and metallic electrodes.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Publicity postcard, giving particulars and price of reflectors for industrial lighting.

QUASI-ARC CO., LTD., 3, Laurence Pountney Hill, London, E.C. 4.—Two illustrated pamphlets; one of 32 pages contains full particulars of the Quasi-Arc system of electric welding for iron and steel, while the other, of 16 pages, contains notes on the system as applied to ship construction.

Non-Ferrous Metal Industry Act.—The *London Gazette* for January 7th contains a list of further licences granted under this Act.

Dissolution and Liquidation.—PECKHAM, DUCAMP AND CO., electrical engineers and manufacturers, 4 and 5, New Compton Street, W.C. 2, and Campbell Works, Campbell Road, Twickenham.—Messrs. G. S. Peckham and J. Ducamp have dissolved partnership. Mr. Peckham will continue the New Compton Street business and attend to its debts. Mr. Ducamp will continue the business at Twickenham, and attend to debts there.

ENGLISH ELECTRICAL CO., LTD.—A meeting will be held at 3, Abchurch Yard, E.C., on February 10th, to hear from the liquidator an account of the winding up of this company, which was formed many years ago, and whose business is now absorbed in the Dick, Kerr organisation.

A Westinghouse Reunion.—Ex-Westinghouse men are holding their first reunion dinner on February 14th, at the Connaught Rooms, London. Any ex-Westinghouse man who has not received an invitation is asked to communicate with Mr. L. S. Richardson, 14, Sydney Road, Richmond, S.W., who will be pleased to furnish all particulars.

Plant for Disposal.—The Central Electric Supply Co. has for immediate sale one 1,560-KW. and one 780-KW. Willans-Oerlikon reciprocating engine and generator complete, and two 1,050-KW. L.P. Oerlikon turbo-generators, 6,000-volt, three-phase. Sheffield Corporation Tramways Committee has for disposal a number of Dick-Kerr tramcar controllers. For further particulars, see our advertisement pages to-day.

Ball Bearings Order Suspended.—The Minister of Munitions has suspended the Ball Bearings Order, 1917, as from January 7th, 1919.

Foreign Trade.—THE DECEMBER FIGURES.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

	December, 1918.	*Inc. or dec.*	12 *months*, 1918. *Inc. or dec.*
IMPORTS.	£	£	£
Electrical goods, &c. ...	59,122	− 40,420	− 286,891
Machinery	792,892	+102,493	+ 1,837,511
EXPORTS.			
Electrical goods, &c. ...	244,379	+ 56,594	− 773,740
Machinery	1,174,320	− 45,374	− 3,420,331

Trade Announcements.—MR. H. ASHDOWN, late managing director of Enterprise Manufacturing Co., Ltd., has opened up a new works, Ashdown Electrical Co., as electrical engineers, at 8, New Inn Yard, Shoreditch, E.

MR. HARRY MOSS, of Bradford, has been demobilised, after serving with the Forces (R.E.'s) since 1916. He is immediately re-opening his business at 116, Horton Grange Road, Bradford, and invites manufacturers and merchants to forward catalogues and price particulars of all lines.

Reconstruction Problems.—No. 10 of the series of twopenny booklets issued by the Ministry of Reconstruction deals with "Labour Conditions and Adult Education."

Book Notices.—The Christmas number of the quarterly *Chloride Chronicle*, published by the Chloride Electrical Storage Co., Ltd., Clifton Junction, contains appropriate Peace notes, references to Chloride staff changes, excellent photographs of Mr. D. P. Dunne, secretary of the company, and Mr. E. C. McKinnon, the engineer, letters from men with the Forces, Chloride men's war honours, and other interesting matters.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII. No. 12. December, 1918. New York: The Institute. Price $1.00.

"Electrical Ignition for Internal-Combustion Engines." By M. A. Codd. Second edition. Pp. vii + 164; 120 figs. London: E. & F. N. Spon, Ltd. Price 6s. net.

"Manual of Electrical Undertakings and Directory of Officials," 1918-19. Vol. XXII. London: Electrical Press, Ltd. 22s. 6d. net.

Dutch Post-War Industries.—Discussing in *De Ingenieur*, November 2nd, the then conditions of trade in general, and the means necessary to protect Dutch trade against the tendency on the part of most Governments to make their home markets secure against foreign competition, D. J. W. Van Dongen refers at length to what has taken place in England, such as the re-organisation of the Consular Service, the introduction of State supervision in factories, and the amalgamation of the engineering interests, and recommends that similar measures should be taken in Holland.

Engineers' Wages in Norway.—The minimum wage schedule for engineers that was accepted last year by the Norwegian Engineers' Association, very soon needed altering owing to the increased cost of living. This has now been carried out and a new schedule established by the Labour Department, according to which the minimum salary for engineers in public services ranking in the grades of engineer-assistants and directors, ranges from Kr.4,000 to Kr.15,000 per annum. The rates now fixed are to be looked upon as minimum rates, and therefore if it is desired to obtain the services of highly qualified men for certain important posts, considerably higher salaries must be offered. At the same time the Engineers' Association put forward proposals with regard to the salaries of managers and engineers on the State railways. Kr.30,000 is to be the yearly salary for a general manager, and departmental managers will receive Kr.20,000.—*Verdens Gang*, November 20th. (Kroner = 1s. 1½d.)

German Efforts to Recover Lost Trade.—As an indication of the endeavours which the Germans are making and propose to make for the purpose of recovering their lost trade, it is of interest to note that they are circularising and dispatching agents to firms and business men in neutral countries, offering to buy shares, or lend money on stock or goodwill as security. These circulars seem to have been sent broadcast to Holland, Denmark, Norway, Sweden, Spain, and Switzerland; and many agents apparently are only awaiting their opportunity to cross the Atlantic as representatives of banking syndicates and industrial establishments, including even Krupp's, the vast armament firm at Essen. Unless the Allies get to business very rapidly when once the Peace Conference has been fairly started on its course, our commercial men and manufacturers generally may find themselves severely hampered by these German attempts to "peg out claims" by the use of money and machinery which rightfully are the property of the nations that have been devastated.—*Birmingham Post.*

German Trade Propaganda in Holland.—The Economic Association for German-Dutch Trade recently informed the *Deutsche Allgemeine Zeitung*, December 1st, that Germany's trade relations with neutral countries were reviving now that peace was approaching and the export prohibitions were cancelled. This was especially evident in the numerous applications from persons resident abroad for appointments as agents of German firms. It was of the greatest importance, both to the exporting and importing countries, that suitable persons should be chosen, and as regards Holland the above-named association placed itself at the disposal of interested parties in both countries, and was prepared to give confidential information as to the reputation, business capacity, &c., of persons who had applied already for such agencies.

The 47-hours' Week: A Strike.—About 2,000 engineers employed at the Thornbury works of the Phœnix Dynamo Manufacturing Co., Ltd., Bradford, came out on strike on January 2nd, in protest against the system of clocking in under the new 47-hours' week agreement, which involves a start at 7.30 a.m., and no period of grace for late-comers except those who are liable to delay by train and other special reasons, to whom special passes are granted. On this day, the first on which the new arrangement was acted upon, about 70 or 80 workers were locked out, but owing to severe weather the works manager admitted them. The employés, however, met inside the works and decided to strike against the system. They contend that the firm violated the old agreement, and should have conferred with the workers before adopting the new course. The employers, on the other hand, contend that the men broke an agreement under which local conferences are to be held on disputes, failing which a central conference is to be held, but work is not to be interrupted. On Friday, the day following the strike, a conference of the parties was held, and it was agreed that work should be resumed on the Monday morning, and that on that morning a further conference should be held on the points in dispute.

Small Traders and Demobilisation.—At the invitations of the Mayors of Southwark and Lambeth, a meeting of small employers of labour was held at the Southwark Town Hall, with the object of enabling the Local Advisory Committee to get into closer touch with them. At present the minor industries, the small trader or "one-man business" owners are not represented on the committee, and considerable difficulty has occurred in ascertaining what men they require from the demobilised Forces. As a result of the meeting two representatives were appointed to serve on the committee. Mr. J. T. Cummings, manager of the Borough Labour Exchange, said there was quite a mistaken idea abroad as to what was meant by "pivotal" men. They must be men upon whom other men depended for their work. They must be the organisers of the work, and must be released at once if they desired to avert a vast number of unemployed men walking the streets. There was no need for men over 43 years of age in the Army to put in applications for release nor for men in hospitals, as these were being demobilised. Men home on leave could also get their discharges if applications were filed. They would not have to go back to France. The "one-man businesses" were worrying the committee. They had received hundreds of applications for the release of these men, and they would be released immediately after the pivotal men. But when the committee scrutinised the forms for the release of many of these so-called "one-man business" owners it was impossible to pass them, though they dealt honestly with the genuine owners. Applications had been received from men describing themselves as owners of "one-man businesses" who were commission agents, newspaper sellers, and similar occupations, who were anxious to get out of the Army. These were not genuine "one-man business" owners, who would be of service to the country.

Returning to Peace Production in America.—A number of electrical manufacturers who have devoted a large part of their manufacturing facilities to the production of shells and other munitions are changing their plants back for turning out their normal electrical products. Little difficulty is being experienced in doing this except in isolated cases. The cancellation of government contracts for shell production has caused the Wagner Electric Manufacturing Co. of that city to dismiss between 800 and 1,000 employés engaged in this work within the last eight or ten days, about 300 being laid off in one day alone. The company was one of the first St. Louis manufacturers to engage in munition work after the start of the war.—*American Electrical Review*, December 14th, 1918.

After Many Years.—An incident which should not be permitted to pass unnoticed was reported to the Finance Committee of the Leeds Corporation last Friday. About 35 years ago the firm of J. & H. McLaren, owners of the Midland Engine Works, Leeds, had to make an arrangement with its creditors, who received 5s. in the pound. A firm of London accountants has just written to the Corporation stating that although no legal obligation rested upon them, it had been one of Messrs. McLaren's life ambitions to pay off their liabilities in full, and they had now placed in their accountants' hands an amount sufficient to pay the balance of 15s. in the pound.—*Engineer.*

Australians and Trade with Germany.—In a letter dated November 9th, and addressed to the Victorian Employers' Federation, Melbourne, Mr. P. J. Pringle, general manager of the Electric Supply Co., of Victoria, suggests that employers' associations "should at once finalise the future action in regard to trading with Germany and Austria. It would seem that some form of appeal by pamphlets and meetings should bring before our members the necessity, both from a self-preservation and a loyal point of view, that goods manufactured in or in any way connected with these countries should be banned. A clearly defined attitude expressed as early as possible seems desirable. Undoubtedly there are many persons and firms sufficiently unprincipled to again act as agents for goods manufactured in these countries. If a clearly defined policy is adopted against such a procedure, it will deter many from acting in this capacity." He further suggests that the pamphlets and illustrated sheets prepared by the *Mining Standard* in regard to Germany and the trade question should be reprinted, and distributed to members on the understanding that such shall be framed and permanently and prominently hung in their places of business—"Lest we forget." He continues:—

"Consideration might also be given to the drawing up of statements, which should accompany all orders to manufacturers and agents, both here and abroad, that they are not stocking goods of German or Austrian manufacture. Unless they are prepared to sign such a statement in the affirmative, no business relations can exist with them. My company intend to act strictly on these lines, but the value of such a procedure would be entirely lost unless it is more or less general and accompanied with a full education and clear explanation of the danger of any other course being followed."

Valuation of Land for Business Uses.—The Ministry of Reconstruction has now issued the second report of the Committee upon the Acquisition and Valuation of Land for Public Purposes. The first report, which was issued last January, recommended measures for cheapening, shortening and simplifying procedure for obtaining compulsory powers for the acquisition of land, a procedure so cumbersome as to involve a delay of many months, and costs of anything from £500 upwards. It was made abundantly clear, moreover, that the committee interpreted the term "public" purposes in the widest sense, to include private, industrial, and business enterprises of public utility, as well as the enterprises of public bodies. In its second report the committee devotes attention to a suitable system for the valuation of land compulsorily acquired.

LIGHTING AND POWER NOTES.

Accrington.—WAGES.—The employés of the Corporation electricity department have been granted a further bonus of 5s. per week, making 28s. 6d. a week, plus 12½ per cent., as from December 7th, 1918.

Argentina.—BUENOS AYRES.—Owing to a dispute between the Primativa Gas Co. and the municipality over the non-payment of the company's bill, the supply to all municipal buildings, except hospitals, has been cut off; the *Times* states that the municipality intends to install oil and electric lighting.

WATER POWER.—The Legislature of the Province of Mendoza has sanctioned plans for the development of the province, including water supply, sewers, and hydro-electric power; the cost is estimated at $13,000,000 m/n.—*Review of the River Plate.*

The Minister of Agriculture, who recently visited the Iguazu Falls, states that they are in no way inferior to Niagara, and considers their utilisation for the generation of electricity to be a feasible project, which should be undertaken as soon as possible. He recommends the appointment of a Commission of Engineers to investigate the project. The falls are 600 to 700 miles distant from Buenos Ayres.—*Pall Mall Gazette.*

Australia.—SYDNEY.—The N. Sydney Council has passed a resolution urging the Government to utilise the water powers of the Nepean, Warragambi, Grose, and other rivers for the production of electricity and the development of the water supply.

SALE—The B.C. has decided to make inquiries with regard to the provision of an electric lighting scheme for the district.

LISMORE.—The electrical engineer has reported upon the question of a municipal electricity scheme for the town. The report states that there are 250 creameries within a 30 miles' radius of Lismore, each of which might be expected to install a 4 or 5-H.P. motor, and co-operation with neighbouring municipalities is recommended.

CORURG.—The T.C. has arranged to borrow £13,000 for the provision of an E.L. installation, and is to take a bulk supply from the Melbourne City Council for ten years.

ELECTRICITY SUPPLY AND STANDARDISATION.—A conference of engineers and managers of electricity supply undertakings, held in Melbourne, reported that as the supply of electricity to small private consumers usually resulted in a loss to supply undertakings, it was necessary that a monthly minimum charge for each service be made. As a supply undertaking might be called upon at any time to give a stand-by supply to premises also supplied from a separate source, and the stand-by might not be used to an extent sufficient to prevent the supply undertaking losing in connection therewith, the conference recommended that future legislation should include protection for undertakings which refused to give or maintain a stand-by supply; this legislation should follow the lines of Clause 15 of the British E.L. Act, 1909. The conference supported the principle of standardisation as applied to the electric supply industry, and was of opinion that British standardisation should be adopted, as far as possible, in Australia. The Advisory Council of Science and Industry was advised that the conference was of opinion that the Commonwealth should, at the earliest moment, establish a Bureau of Electrical Standards.

Barrow-in-Furness.—WAGES.—The T.C. has increased the wages of the employés of the electricity department in receipt of wages not exceeding £300 per annum by 5s. per week. Consideration of an application for an advance of £65 per annum by the chief Corporation officials has been deferred.

SEWAGE PUMPING.—The application of electricity to the sewage pumping plant is to be proceeded with as soon as possible by the T.C. Health Committee.

Belfast.—TURBINE BREAKDOWN.—With regard to the breakdown of one of the turbines at the T.C. electricity works some weeks ago, a report by Mr. J. H. Rider stated that the breakdown was due to purely accidental causes, and there had been no neglect or want of skill on the part of the employés.

EXTENSIONS.—In connection with the Harbour power station, the construction of which was pushed on at the request of the Government, in order to facilitate shipbuilding, the chairman of the E.L. Committee has stated that the negotiations in progress justify them in believing that they will be put in the same financial position by the Government as if they had waited another couple of years before undertaking the extension.

Chelmsford.—PRICE INCREASE.—The B. of T. has authorised the Electric Supply Corporation to increase its charges for electricity from 6½d. to 8½d. per unit.

STREET LIGHTING.—As the contract with the E.S. Corporation for the lighting of the North and South Wards expires in March, 1920, the Gas Committee has recommended the Lighting Committee to consider the advisability of lighting the wards by gas.

Crediton.—PROPOSED E.L.—The U.D.C. has decided to obtain expert advice as to the provision of an E.L. scheme for the town.

Croydon.—PRICE INCREASE.—The T.C. has decided to further increase the charges for electricity by 25 per cent., a total advance of 100 per cent. on pre-war rates.

Doncaster.—PROV. ORDER.—The T.C. has decided to apply for an order to supply electricity in the parishes of Adwick-le-Street, Carcroft, Bentley, Kirk Sandall, Armthorne, Cantley, Rossington, Wadworth, Loversall, Edlington, Conisborough, and Denaby.

PLANT EXTENSIONS.—The electrical engineer has been instructed by the T.C. to prepare a report on the additional plant required in connection with the proposed extension of the area of supply and the tramway system. It was also decided to ascertain whether any of the collieries in the district would be willing to furnish supplies of electricity, if required.

Dover.—SUPPLY TO ADMIRALTY.—In order to induce the Admiralty to increase its payment for electricity, the Electricity Committee has decided to threaten that the rate for the establishments outside the contracts will be raised to the maximum unless the Admiralty meets the Corporation in the matter.

The price of energy for charging electric vehicles has been increased from 1·8d. to 3d. per unit, and for power from 3d. to 3½d.

Grimsby.—STRIKE.—The application of the engineers at the electricity works with regard to working hours having been refused, they struck work on Friday evening last. The whole of the municipal electricity supply ceased, involving the stoppage of the tramways. An offer of assistance from the Naval authorities was accepted, and a contingent from mine-sweepers was put in charge of the station.

Hull.—STREET LIGHTING.—The Works Committee has instructed the electrical engineer to present a report on the extended use of electricity for street lighting.

Ilford.—PROPOSED LOAN.—The L.G.B. having refused to sanction the application of the U.D.C. for permission to borrow £10,000 for a scheme for the utilisation of the steam from the refuse destructor, the electrical engineer has been instructed to submit another scheme, with a view to a further application being made.

Ipswich.—NATIONAL ELECTRICITY SUPPLY.—On the recommendation of the chief engineer, Mr. F. Ayton, the E.S. and Tramways Committee has passed a resolution, with instructions that it be forwarded to the President of the B. of T., to the effect that the Committee, having considered the report of the I.M.E.A. to the B. of T. upon electric power supply, dated November 29th, 1918, expresses its agreement therewith, except in regard to Clause 2, wherein the Association recommends that the District Electricity Boards should be so constituted as to be wholly independent of the influence or control of commercially-owned electrical enterprises; and that in order to secure this object, it is urged that the District Electricity Boards should consist of representatives of local authorities and large consumers, to the exclusion of the supply companies. The Committee strongly dissents from this view, and holds the opinion that the District Electricity Boards should consist of representatives of the undertakings concerned in electricity supply, and that where there are company-owned undertakings, these should not be excluded from representation on the boards.

Kingston-upon-Thames. — E.L. FAILURE.—For the third time in a few weeks the Corporation's electric light supply failed on December 31st.

In speaking at a meeting of the T.C. on the difficulties which had attended the supply of electricity during the past few weeks, the chairman of the E.L. Committee said that they were first faced with the breakdown of the condensing plant, and, owing to the inferior quality of the coal, it was impossible to maintain sufficient steam, and the works had to be closed down. Following that, two of the largest steam alternators broke down, the coils being burnt out, and later another set broke down. Also, during the past three months, both the Diesel engines had been out of working order, and other difficulties were caused by the overloading of the plant; it was only due to the determined efforts of the acting electrical engineer and staff that the supply had been kept going at all. He expected that the first new turbine would be working regularly early in January, and he hoped that would be the end of their difficulties. Alderman Hall said it was a lamentable thing that they ever had the two German engines, which at present were incapable of work. A British firm had now agreed to supply a new compressor for the four-cycle Diesel engine.

Kendal.—PRICE INCREASE.—The E.L. Committee has increased the price of electricity for power purposes by charging 2½d. per unit for 2,000 units per annum and over, instead of 2¼d. for 8,000 units and over.

Lighting Restrictions.—The Controller of Coal Mines has given notice that the conversion equivalent for gas, in terms of fuel, has been increased to 18,750 cb. ft. per ton, and for electricity to 1,000 units per ton. The allowance of gas or electricity for lighting purposes under Clause 8, or the special assessments for lighting under Clause 12 of the Household, Fuel, and Lighting Order, 1918, has been increased by 25 per cent. Clause 99 of the Act, relating to restrictions on gas and electrical fittings, has been suspended. The concessions only relate to England and Wales, and take effect from January 1st last.

London.—EAST HAM.—STREET LIGHTING.—When the lighting restrictions are removed, the E.L. Committee has decided to install 1,000-C.P., half-watt lamps in place of the arc lamps previously used for public lighting, and has recommended that the work of fixing the cables, which will be carried by the tramway standards, be put in hand.

Lytham.—PROPOSED E.L.—At the last meeting of the U.D.C., the chairman said he hoped the Council would push on with the electric lighting of the town.

National Electricity Supply.—The B. of T. Bill for the provision of cheap electricity is to be introduced into the House of Commons at the earliest possible date. A Central News representative states that "Mr. Lloyd George is anxious to get the scheme into working order, and it is now only a question of how soon the necessary Bill can be introduced into the House."

Newcastle-under-Lyme. — MAINS EXTENSIONS. — The T.C. has received L.G.B. sanction to the borrowing of £1,250 and £350, for the extension of the electricity mains.

Rochdale.—PROPOSED BULK SUPPLY.—The E.L. Committee has recommended the T.C. to obtain terms from the Oldham and Bury Corporation for a supply of electricity in bulk.

Rotherham.—Owing to the delay in the erection of the new power station causing an accumulation of the sinking fund, a Sub-Committee has recommended the T.C. to promote a Bill to postpone the sinking fund periods with respect to the loans raised, to pay interest charges out of capital, and to alter the periods granted by the L.G.B. for the raising of loans until the new station is completed.

Salford.—WAGES.—The award of 5s. per week granted to the engineering trades by the Committee on Production, dated November 9th, 1918, has been extended to employés at the electricity works.

SALE OF PLANT.—The Electricity Committee has given instructions for the sale of the second 1,000-KW. turbo-alterator.

PRICE INCREASE.—The T.C. has accepted the offer of the Manchester Ship Canal Co. to pay an increase of 10 per cent., making a total of 20 per cent., on the charges for electricity.

Stretford.—TERMS OF PURCHASE.—The sum provisionally agreed upon for the purchase of the undertaking of the Trafford Power and Light Supply Co. by the U.D.C. is £184,342; this is subject to ratification by the shareholders of the company and the L.G.B.

Spennymoor. — STREET LIGHTING. — The U.D.C. has decided to have 74 public lamps lit by the E.L. Co.

Swansea. — PLANT EXTENSIONS. — The Director of Electric Power Supply has consented to the T.C. renewing its application for additional boiler plant, &c., in three months' time.

Tunbridge Wells.—STREET LIGHTING.—The T.C. has fixed the following charges for lighting public lamps with electricity:—1,200 C.P., £24 per annum each; 300 C.P., £15; 100 C.P., £5; 50 C.P., £3; clocks, £10 10s.

United States.—HETCH HETCHY SCHEME.—On December 9th San Francisco closed the sale of $1,000,000 of Hetch Hetchy bonds to the Anglo and London-Paris National Bank. The purchaser also took an eight-month option on the remaining $8,000,000 of 4½ per cent. bonds now authorised for sale. The $1,000,000 to be immediately available will cover construction costs during the next six or eight months. The $8,000,000 would cover the construction of the dam and the first section of the aqueduct. An effort will be made to complete the work as far as the Moccasin Creek power development as soon as possible, so that the 66,000 H.P. to be generated there will be available for the city's use.

York.—WATER POWER.—The Electricity and Tramways Committee has decided to proceed with a scheme for the generation of hydro-electric energy, and has recommended that the necessary permission be obtained; a site has been rented at Naburn Locks, on the River Ouse.

TRAMWAY AND RAILWAY NOTES.

Accrington.—At a meeting of the T.C., on Monday, a resolution was adopted condemning the tramway employés for refusing to work on Christmas Day. Alderman Higham, chairman of the Tramways Committee, said that another year the cars would certainly have to be run on Christmas Day.

Australia.—MELBOURNE.—In November a trial run was successfully made on the new electric railway between Newmarket and Essendon, and a speed of 50 miles per hour was attained. Energy is supplied from Newport at 20,000 volts A.C., and transformed to 1,500 volts D.C.

Bolton.—At a general meeting of the members of the Bolton Branch of the Tramway and Vehicle Workers' Amalgamation, held on Sunday morning, it was decided to give financial support to the Blackburn tramway strikers, and also to take a ballot during the week as to giving moral support by ceasing work when called upon to do so by the Executive Council.

Central London Railway.—The B. of T. has further extended the time for the completion of new works under the C.L.R. Act, 1913, for a year.

Continental.—ITALY.—The first stone of the new electric railway between Rome and Ostia was laid on December 30th. The King was present, and signed a commemorative tablet, which was enclosed in the stone. The project includes the building of a harbour and a seaside residential resort within half-an-hour's run of Rome.

Dewsbury.—PROPOSED NEW LINES.—The Corporation has deferred consideration of an offer of the National Electric Construction Co. to construct tramways to Shaw Cross.

Keighley.—WAGES AND FARES.—In view of the recent award of the Committee on Production increasing the wages of tramcar drivers and conductors, the T.C. has decided to increase the fares to 1d. per mile.

Leeds.—FARE REVISION.—The Tramways Committee has recommended the T.C. to apply for powers to increase the tramway fares to 1d. per mile, with a minimum charge of 2d. for any distance exceeding ½ mile, and to increase the charges for goods traffic by 100 per cent.

Lincoln.—NEW CARS.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £6,000 for the purchase of three tramcars.

The engineer has been instructed to report on the conversion of the existing tramways to the overhead system.

Liverpool.—STRIKE.—Owing to the fact that the 47-hour week granted to the railway men on the 1st inst. does not apply to them until February 1st, the skilled workers at the Formby power station of the L. & Y. Railway Co. struck work on January 2nd. Traffic was stopped on the electrical lines in the Liverpool area, and the electric trains on the Liverpool-Southport line were replaced by steam trains, which, however, were not illuminated. At a meeting on Monday the men decided to resume work on Tuesday, providing the N.U.R. obtains a satisfactory settlement of their grievance, but threatened to resume the strike on Saturday if it was not settled.

Maidstone.—PROPOSED EXTENSIONS.—The T.C. is to consider a scheme involving an expenditure of £100,000, for the extension of the tramways to Chatham.

Salford.—WAGES.—The award of 5s. per week granted by the Committee on Production, dated November 9th, 1918, has been extended to the employés of the tramways department; the estimated annual cost is £1,220.

Sheffield.—SNOWSTORM.—Much damage was done to tramway trolley wires by the snowstorms last week-end, the service being completely disorganised. At Mansfield a telephone wire fell across the tramway trolley wires. A horse which trod on the wire received a shock and burns.

At Halifax a girl came in contact with a fallen "charged" wire, and received burns.

Walkden.—The colliers—with the release of men from the Army and Navy, their numbers are now growing—in Walkden and adjoining coalfields are now agitating for the provision of more cars in the afternoon to take them home as they leave work. They complain that the service provided, whilst better than it used to be, is often inadequate.

TELEGRAPH AND TELEPHONE NOTES.

Cable Breakdown.—An official of the Eastern Telegraph Co. informed a newspaper representative that telegrams to the Far East were being delayed 3½ days, owing to the breakdown of a cable on Sunday last; it was expected that the service would be restored in a few days.

Control of Wireless.—It is stated in the daily Press that an understanding has been come to between the Allies to exercise permanent Government control over all wireless communications. The U.S. Government is going further than this, and proposes to acquire all the shore wireless stations at an expenditure of £1,000,000. They will all be under the control of the Navy Department, and all German stations erected on U.S. territory are to be appropriated.

Snow Storms.—During the snow storms last week-end the telegraph and telephone services in the Midlands and West of England were seriously interrupted. Communication between Bath and parts of Wiltshire, Somersetshire, and Gloucestershire was cut off. Sheffield was practically isolated, while Manchester was cut off from 22 of the 40 large towns with which there is usually communication by telephone. Telegraphically also the city was completely isolated from at least a dozen large towns. In Yorkshire and Derbyshire 10,000 wires are down.

South America.—A new wireless station on Martin Garcia Island was declared open for public service on October 29th last.

Telegrams to Enemy Countries.—Until further notice no private telegrams of any description can be accepted for transmission to enemy countries. Telegrams for soldiers, addressed to their units, without indicating place of destination, will be forwarded whenever possible from the base.—*The Times.*

Trunk Telephone Delays.—Many complaints by business men at the delays on trunk telephone calls were considered, last week, by the Post and Telegraph Committee of the London Chamber of Commerce. The Committee decided to call a meeting of the London Telephone and Telegraph Committee of the Chamber with a view to action being taken.

In connection with the complaints, the Assistant Secretary to the Telephone Department, G.P.O., has explained to the daily Press that the delays are caused by the priority given to Government calls; also long-distance lines have been appropriated by the Government. New construction for civil purposes has been practically suspended for three years. As the necessity for priority is daily decreasing, and appropriated lines are being returned for general use, conditions are now being improved. Plans are being prepared for the construction of new lines, and it is expected that the system will soon be back to normal conditions.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—Corporation Electricity Department. Five-ton tipping wagon for coals. Electric vehicle preferred, but not essential. See "Official Notices" to-day.

Australia.—SYDNEY.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.

MELBOURNE.—March 10th. City Council. One 5,000-KW. frequency changer, high-tension switchgear. Specification (£1 1s.) from City Electrical Engineer.

London.—HAMPSTEAD.—B.C. January 16th. Twelve months' supply of electrical engineers' stores and oils for the Electricity Station. Mr. A. P. Johnson, Town Clerk, Town Hall, Haverstock Hill, N.W.

Sheffield.—Corporation Water Department. Two 3-ton steam locomotive cranes and one 5-ton electric locomotive crane, D.C., 460—500 volts. See "Official Notices" to-day.

Spain.—The municipal authorities of Santa Eufemia (Province of Cordoba) have lately invited tenders for the concession for the electric lighting of the town during a period of ten years.

Uxbridge.—January 21st. U.D.C. 25-H.P. A.C. motor for the sewerage works. Mr. W. T. Harvey, Clerk, 63, High Street, Uxbridge.

Warrington.—January 28th. Electricity and Tramways Committee. One 300-KW. and one 500-KW. rotary converter. See "Official Notices" to-day.

CLOSED.

Glasgow.—T.C. Tramways Committee. Recommended:

Steel tires.—Jno. Baker & Co.
Trolley bushes.—Fleming, Birkby & Goodall, Ltd.
V.I.R. cable.—Liverpool Electric Cable Co., Ltd.
Asphalt buckets.—P. & W. M'Lellan, Ltd.
Copper bonds.—B.I. & Helsby Cables, Ltd.
Trolley wire.—F. Smith & Co., Ltd.
40/36 C.T.S. cable.—W. T. Henley's Telegraph Works Co., Ltd.
Lead-covered cable.—B.I. & Helsby Cables, Ltd.
Iron castings.—Carron Co., British Hydraulic Foundry Co., Ltd., R. Howie & Co., David King & Sons, Ltd.
Malleable iron castings.—A. Shanks & Son, Ltd.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, January 10th. At 8 p.m. At the Holborn Restaurant (Venetian Chamber). Smoking concert.

Manchester Association of Engineers.—Saturday, January 11th. At the Grand Hotel. At 6.30 p.m. Paper on "Iron and Steel Electric Furnaces," by Mr. J. Bibby.

Birmingham and District Electric Club.—Saturday, January 11th. At the Grand Hotel. At 7 p.m. Presidential address on "Problems of the Future," by Mr. W. H. Varnom.

Institution of Civil Engineers.—Tuesday, January 14th. At 5.30 p.m. At Gt. George Street, S.W. 1. Ordinary meeting.

Industrial Reconstruction Council.—Tuesday, January 14th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Reconstruction or Restoration," to be opened by Major H. J. Gillespie, D.S.O.

Institution of Electrical Engineers (North Midland Centre).—Tuesday, January 14th. At 7 p.m. At the Metropole, King Street, Leeds. Paper on "Carbon Brushes: Considered in Relation to the Design and Operation of Electrical Machinery," by Mr. P. Hunter-Brown.

(North-Western Centre).—Tuesday, January 14th. At the Engineers' Club, Manchester. At 7 p.m. Tenth Kelvin Lecture on "The Dynamical Theory of Electric Engines," by Mr. Ll. B. Atkinson.

(Scottish Centre).—Tuesday, January 14th. At the Princes Street Station Hotel, Edinburgh. At 7 p.m. Paper on "The Supply of Single-phase Power from Three-phase Systems," by Prof. Miles Walker.

(Students' Section).—Friday, January 24th. At 7 p.m. At the Northampton Polytechnic Institute, Clerkenwell, E.C. Paper on "A General Outline of Telephony," by Mr. H. T. Body.

Belfast Association of Engineers.—Thursday, January 16th. At the Municipal Technical Institute. At 7.45 p.m. Paper on "Electric Welding," by Mr. K. Edwards.

Royal Institution of Great Britain.—Friday, January 17th. At 5.30 p.m. At Albemarle Street, W. Lecture on "Liquid Air and the War," by Prof. Sir. Jas. Dewar, F.R.S.

LEGAL.

THE TRADE MARK "MEGOMIT."

BEFORE the Controller of Patents (Mr. H. Temple Franks), in the Patents Court, London, on Thursday, an application was made by Albert Taylor and John Moores, trading as John Moores & Co., manufacturers and suppliers of insulating materials at Brougham Street Works, Blackfriars Road, Salford, Manchester, for the avoidance or suspension of the trade mark "Megomit," registered under No. 216,033 in Class 50, for "electrical insulating material in which mica forms the base and the predominating ingredient," and also for the avoidance or suspension of such part of the Trade Mark No. 276,811 as consisted of the word "Megomit," registered in Class 50 for "an electrical insulating material covered by that class, mica being the predominating substance therein."

MR. E. J. TRUSTRAM, who appeared for the applicants, said that the registration of the marks was by Meirowsky & Co. Akt. Gesellschaft, of Cologne, dealers in and manufacturers of mica; the registration of No. 216,033 was on August 2nd, 1898, and there was a renewal in 1912. No. 276,811 was registered on October 28th, 1905. The manufacture of these mica electrical insulating materials had formed part of the applicants' business for many years. Before the opening of the war they found it impossible to develop and increase the sale of mica insulating material, being everywhere met by the German megomit, to which engineers and others had become accustomed. Since the war they had endeavoured to develop their trade in this line, but although they had somewhat increased their business, they were still met on every hand with inquiries for megomit. Engineers knew that megomit contained mica. The applicants knew that their mica plate contained mica, and was more than equal to megomit, but they could only quote for their various kinds of mica plate and micanite and explain to customers that they could not sell them as megomit. The specification or formula for the applicants' mica plate entirely corresponded to the specification or formula for megomit. With one exception only the whole of their mica and micanite was manufactured locally. The exception came from America and Switzerland. If they were allowed to sell their mica goods as megomit they could secure many orders, and largely increase the local industry. The Controller said that if there was to be avoidance of the trade marks it would have to be on the ground that it was a bad trade mark, as being the only practicable name for a specific article. For years, apparently, this substance had been largely sold as micanite and megomit, and the Germans had not monopolised the whole trade, as in the case of "aspirin."

After some discussion, the CONTROLLER said that it would be impossible to say that megomit was the only practicable name of a specific article, without which it would not be possible to sell the article, and they had laid down the rule that suspension could only be granted where the trade mark was the only practicable name of the article manufactured. Megomit was used as the name of a brand made in Germany, and it could not be transferred to anybody else. It would not be fair to avoid the mark altogether. In the case of aspirin, this had undoubtedly become the only name by which the public would buy the article. Under these circumstances, he thought at the present stage the application could not be granted. The applicants, when asked for megomit, should say it was German, and could not be got, and in that event the customer should be patriotic, and buy English goods.

Eventually the hearing was adjourned for further information to be submitted to the Court.

NOTES.

State and Technical Research in Germany.—According to *Welthandel*, December 6th, the Imperial Economic Office proposes to extend its functions to include the examination of scientific and technical methods of development, and offices are to be opened to collect material and assist in the solution of important practical problems. The first of these offices is to deal with the further utilisation of coal, with the object of increasing the productivity of available stores. Similar offices for other sections of industry are also about to be opened.

Hours of Labour in Australia.—There is a possibility of industrial turmoil in Australia in 1919, because members of Unions are demanding a 42-hours' week and higher wages, but the Governments of all the States are confident that Bolshevism will not become a serious menace.—*The Times.*

Educational.—BATTERSEA POLYTECHNIC.—A course of 12 lectures on "Solutions of Alternating Current Problems by Symbolic Methods," will be given on Friday evenings, commencing January 17th. The evening courses on D.C. and A.C. Engineering, Generation, Transmission and Distribution, will commence on January 13th. Day courses on January 14th. For further particulars, see our advertisement pages to-day.

The Electro-Harmonic Society.—The smoking concert, which will be held at the Holborn Restaurant in the Venetian Chamber to-night (Friday) at 8 p.m., will be presided over by Mr. W. W. Bradfield, C.B.E. The artistes will be:—Mr. Leonard Lovesey, tenor; Mr. Arnold Stoker, baritone; Mr. Wilfred James, bassoon; Mr. Walter Newman, humorist; Mr. Arthur Brough, ventriloquist; Mr. Thomas Sidney, entertainer at the piano; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

The Grading of Electrical Artisans.—A correspondent, discussing the relative status of "wiremen," "electrical fitters," and "electricians," remarks that there are many difficult questions when dealing with labour matters; to him it is obvious that to be just to both master and man, they should be graded in rates. The present method of rate fixing is unjust to both master and true craftsman. The lower grades of craftsmen are certainly not worth 50 per cent. more than the labourer, and, personally, he has found the best of the labourers far better than many of the craftsmen.

The lower grades of craftmanship always call for the greater numbers, and, as a result of present methods, are overpaid in comparison with the labourer; the lowest grade of labour should be the basis—*i.e.*, for the living wage.

It certainly appears to us desirable that the terms above mentioned should be defined and classified, and this is rightfully the function of the Electrical Trades Union, which, if it claims to be a craft Union, ought to know and state the exact grade of every one of its members. It will be remembered that in the Committee on Production's award of last November the three classes were lumped together.

Demobilisation.—Mr. T. W. Cole, secretary of the Provincial Electric Supply Committee of the United Kingdom, writing under date January 8th, says:—"You were good enough to publish a letter of mine on the above subject in your issue of November 29th, 1918, in which I said that my Committee had taken the matter up with the authorities so as to ensure that the electric supply industry was placed among the "key industries," so as to be entitled to priority in regard to the return of their men in the Army. I have had further correspondence with the Demobilisation authorities, and undertakings will be pleased to know that Public Utility Companies (Group No. 35) have now been placed as one of the industrial groups open for making up drafts for Demobilisation subject to certain provisions which have been notified in the daily Press."

The "Tanks" Inaugural Dinner.—The new social body—the Tanks Association—held its inaugural dinner and concert at the Connaught Rooms, on Monday night. It has been formed with the object of bringing together at least once a year those who during the war were connected with tanks, those eligible for membership being members and ex-members of the Mechanical Warfare Department, officers and ex-officers of the Tank Corps and armoured cars, and representatives of the firms engaged in the manufacture of tanks and their components. Lieut.-Colonel Sir A. G. Stern, to whose initiative is largely due the Government's adoption of tanks as an arm of the Services, is president of the new Society, and the vice-presidents include, among others, Sir William Tritton, Major-General Elles, and Vice-Admiral Moore. The aims of the Association are philanthropic as well as social, and it is proposed to establish a scholarship in the engineering profession for the children of members.

Wireless in the Air Service.—Addressing the London Chamber of Commerce, on Tuesday last, on the commercial air service which is likely to be organised in the near future, Major-General Sir F. H. Sykes, Chief of the Air Staff, declared that the problem was largely one of navigation, meteorology, and wireless. An organisation capable of centralising at the starting point all information about the immediate weather conditions all along the route was essential. A development, which would be of the greatest use for enabling machines to fly in all weathers, was the direction-finding wireless apparatus carried in all aircraft for ascertaining the bearing of ground wireless transmitting stations. This method was at present secret, and was developed in the service during the war. Aircraft so equipped could fix their position frequently, and could report to their base at any moment where they were, what course they were steering, or if they were in any difficulty. The ground transmitting stations were, in fact, a form of aerial lighthouse, unaffected by fog and with a range of 600 or 700 miles. In his opinion, it was essential that the development of wireless telegraphy should take place along broad imperial lines. British aircraft would soon be as widely spread as the British Empire.

Volunteer Notes.—ROYAL ENGINEERS VOLUNTEERS, LONDON ARMY TROOPS COMPANIES.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 2, by Lieut.-Colonel C. B. Clay, V.D., Commanding. Monday, January 13th, to Saturday, January 18th, drills as usual.

C. HIGGINS, Captain, R.E., *Adjutant.*

Stocks of Non-Ferrous Metals.—The Ministry of Munitions publishes the following particulars of the stocks (exclusive of old metals and scrap) in this country in the possession of the Minister on January 1st:—

	Tons.		Tons.
Copper	36,000	Soft pig lead	62,852
Spelter, G.O.B. ...	22,273	Nickel	2,096
Spelter, refined ...	8,017	Antimony regulus ...	3,508
Aluminium	11,957		

It is intended, the Ministry states, to publish at monthly intervals the stocks held on the first day of each month. In addition to the above, the Minister holds large quantities of scrap, mainly brass, of which it is impossible to give any particulars at present.—*The Times.*

The Fuel and Lighting Order.—The Coal Controller has announced that, commencing with the New Year, the allowances of gas and electricity for fuel and lighting under the Household Fuel and Lighting Order, 1918, will be increased by 25 per cent. For the present this concession relates only to England and Wales, and does not apply to Scotland. At the same time, it is proposed by arrangement with the Ministry of Munitions to suspend all restrictions on the fitting of gas and electrical equipment. Economy of coal is still necessary.

In accordance with this decision, the conversion equivalent for gas in terms of fuel will be increased to 18,750 cb. ft. to the ton, and for electricity to 1,000 Board of Trade units to the ton as from the meter readings taken for the close of the quarter ending December 31st last (except in those cases in which a higher conversion equivalent has already been specially agreed.) The allowances for lighting under Clause 8, or the special assessments for lighting agreed under Clause 12 of the Order, will from such meter readings be likewise increased by 25 per cent. Further, the Controller agrees to the suspension of Clause 99 referring to the restrictions on gas and electrical fittings as from the 6th inst.

Institution and Lecture Notes.—Birmingham and District Electric Club.—The arrangements for the first half of the 1919 session are as follows:—

January 11th.—Presidential address, "Problems of the Future," by Mr. W. H. Varnom.
February 8th.—Paper on "Signalling," by Captain F. H. Woodrow, R.E.
February 22nd.—Annual Dinner, Grand Hotel.
March 8th.—Paper on "Electric Welding as a Commercial Proposition," by Mr. H. W. Wolton (vice-president).
April 19th.—Paper on "Electric Converting Plants," by Mr. F. Gould.

Institution of Electrical Engineers.—In order to enable the necessary arrangements to be made, members wishing to dine together at the Waterloo Restaurant, Charles Street, Haymarket, after the I.E.E. Meetings, are asked to send their names to the Institution Offices, not later than the Wednesday morning preceding the meeting. Owing to food difficulties, the proprietor of the restaurant is unable to cater for an unspecified number of visitors.

Chadwick Public Lectures.—Mr. A. H. Barker, B.A., B.Sc., is delivering a course of three lectures on "Fuel Economy and Health," at the Royal Society of Arts, John Street, Adelphi, W.C. 2, on Mondays, January 6th, 13th, and 20th, at 5.15 p.m. The ground covered on the three occasions will be:—"The Heat Requirements of the Human Being"; "The Heat Requirements of a House"; "Heat Economies."

Electrical Power Engineers' Association.—A meeting will be held at the White Lion Hotel, Coventry, at 6.45 p.m. to-day, for the purpose of forming a South-Eastern Section of the Midland Division. All engineers interested will be cordially welcomed.

The Liverpool Section of the Northern Division has arranged for a smoking concert to be held at the Bee Hotel, Liverpool, at 7 p.m. on Wednesday, January 15th. Each member will have the privilege of bringing one friend. Tickets may be had from members of Committee or corresponding members.

Appointments Vacant.—Shift engineer (77s.) for the Farnworth U.D.C. Electricity Department; shift engineer (78s. 9d.) for the Woking Electric Supply Co., Ltd.; instructors in mechanical and electrical engineering for the Stoke-on-Trent Education Committee; charge engineer (70s. + 23s. 6d. + 12½ per cent.), for the Croydon Corporation Electricity Department; shift engineer (37s. 6d. + 20s. + 12½ per cent.), for the Peterborough Corporation Electricity Department; meter mechanic and test-room assistant (£4), for the Newport B.C. Electricity Department; chief assistant engineer, for the Bo'ness Electric Power Station; sub-station attendant (35s. + 28s. 6d. + 12½ per cent.), for the Walsall Corporation Electricity Supply Department; meter tester (45s. + 28s. 6d. + 12½ per cent.), for the Barrow-in-Furness Corporation Electricity Works; shift engineer (93s. 6d.), for the Warrington Corporation Electricity and Tramways Committee; charge engineer (£175), for the Worcester Corporation Electricity Works; mechanical and electrical engineer (£350), for the Docks Committee of the Bristol Corporation; mains superintendent (£425), for the George Town, Penang, Municipal Electric Light and Tramways Department. See our advertisement pages to-day.

The Women of Coblentz.—The *Times* correspondent with the American Army at Coblentz, in the course of a recent dispatch, says :—"Already in Coblentz there is considerable unemployment, and large numbers of demobilised soldiers are anxious to oust women from the well-paid positions they hold as tramway-car conductors and in other municipal services, as well as in industrial and commercial undertakings. Despite all the efforts of the German authorities to induce the women and girls to go back to household work, little or no progress is being made. The women refuse to resume their pre-war status in the community."

Electrical Development in Japan.—Statistics compiled by the Japanese Department of Agriculture show, says the *Journal of Electricity*, that almost 16 per cent. of Japan's hydro-electric and steam-electric power development took place during the 12 months prior to 1918. The total water-power development completed was 416,385 KW., with uncompleted projects under way amounting to 317,131 KW. Similarly, the steam-electric power showed completed projects to the amount of 118,968 KW., and uncompleted of 158,754 KW. In comparing this power development programme of 1,011,243 KW. with the completed and uncompleted programme of the previous year it was found that the year 1918 showed an increase of 156,330 KW., of which 73,184 KW. was for water power, and 83,146 KW. for steam power development. The total number of electrical enterprises, including power and railway, was 687, representing a capitalisation of about $365,000,000, which compared with the same date of the previous year showed an increase of 39 enterprises with a capitalisation of $32,595,000. An idea of the magnitude of some of these enterprises may be gleaned from a statement of three typical power installations of the Tokio Electrical Light Co., the Inawashiro Hydro-Electric Co., and the Ujigawa Electric Co., the first two supply in Tokio and the last the great industrial centre of Osaka, as follows:—

	Capacity (kw.)	Max. voltage.	Distance (miles).
Tokio Light No. 2 ...	35,000	55,000	50
Inawashiro No. 1 ...	35,000	115,000	140
Ujigawa	25,000	66,000	30

Electricity on Board Ship.—Referring to the British section of the Allied Fleet taking over that portion of the Russian Black Sea Fleet which had been seized by the Germans, a Press correspondent says that all the machinery on the battleship *Volya* was electrical, and the whole arrangement of the ship differed from anything known in the British Navy.

Requirements of Russian Engineering Works.—The *N.A.Z.*, November 1st, in commenting on the requirements of the Russian engineering industry, remarked that under normal labour conditions 14 million poods of metal would be needed. Up to the present about 4 million poods of fresh and 200 million poods of old metal have been registered. There is a sufficient quantity of copper forthcoming. The amount of pig-iron essential is estimated at 13 million poods, which can only be supplied when the coal shortage is relieved. Owing to lack of coal a number of works in Tula and Tombov have had to close down. The Petrograd Soviet has sanctioned R.12 million for purchasing machine parts and technical materials in Scandinavia.

Referring apparently to the same matter, the *Deutsche Allgemeine Zeitung* of Nov. 25th said that the Commissaries of the Petrograd communal administration had decided to purchase machinery and materials from various undertakings in Sweden, and had voted R.12 mill. for the purpose.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—Mr. F. M. FLETCHER, chief assistant electrical engineer at the Rochdale Corporation electricity works, has been appointed electrical engineer to the Darwen Corporation.

Rotherham T.C. has decided to increase the salary of Mr. E. CROSS, the borough electrical engineer, by two annual instalments of £125, making a maximum of £1,000 per annum.

Mr. E. E. HOADLEY, borough electrical engineer at Maidstone, has been installed Worshipful Master of the Belvedere Lodge of Freemasons.

Bangor T.C. has decided to increase the salary of the electrical engineer by £20 a year, the present bonus being continued.

Doncaster Corporation Special Electricity and Tramways Sub-Committee has recommended that the pay of the shift engineer at the power station be increased to £4 per week, and that the increment due to Mr. J. W. HIBBERT in November, 1919, shall take effect as from January 1st, 1919; that Mr. T. POTT's salary be increased to £275 per annum from January 1st; and that the borough electrical engineer's salary be increased from £550 by an amount equivalent to 28s. 6d. per week, plus 12½ per cent., with a deduction of £50. The Town Council, in committee, has adjourned the proposal so far as concerns the borough engineer, pending a report by the Finance Committee upon a recent circular of the Local Government Board dealing generally with certain war allowances for administrative, technical, and clerical staffs of local authorities.

Exeter T.C. has increased the salary of the tramway manager from £300 to £350 per annum.

Rochdale Town Council has approved the Electricity Committee's recommendation to increase the salary of Mr. F. H. RUDD, the borough electrical engineer, from £450 to £500 a year, as from November 1st last, thus anticipating the increase promised for next August.

Mr. R. U. BAILEY, resident engineer, Nechells generating station, Corporation of Birmingham electric supply department, has resigned in order to take up the appointment of Birmingham representative for Messrs. Brown-Bayley's Steelworks, Ltd., Sheffield.

Having regard to the extra work consequent upon the shortage of staff at the power station, and the increasing difficulties which have arisen during the war, the Northampton Tramways Committee proposes that Mr. CAMERON, the tramway manager, shall be granted an honorarium of £100.

Horsham U.D.C. has increased the salary of Mr. H. L. COTTAM, electrical engineer, to £300 per annum as from December 31st, 1918.

Chesterfield T.C. has accepted the resignation of Mr. R. L. ACLAND, electrical engineer and tramway manager, and has decided to appoint him consulting engineer at a salary of £100 per annum. The Electricity Committee recommends that no appointment to the vacant position be made at present, but that Mr. TOPPIN, assistant electrical engineer, be in charge of both departments.

Mr. MARK RUDDLE, chief electrical engineer of the Dublin Corporation, has tendered his resignation on the ground of ill-health. He became engineer and manager of a large chemical works in Portsmouth in 1874, and some years later joined the Bell Telephone Co., which, in 1880, amalgamated with the Edison Co., of New York. When the Edison Syndicate started in London, the New York directors appointed Mr. Ruddle one of their engineers, and under his direction the first system of underground cables was laid down. Later, when the Edison Syndicate started a local company at Manchester, he became its chief engineer, and subsequently he was engineer to the Metropolitan Electric Lighting Co. His association with Dublin municipal affairs began 28 years ago. He was engineer of the mains under Sir Alex. (then Mr.) Kennedy, and afterwards acted under Mr. Hammond, whom he succeeded as engineer-in-chief. Mr. Ruddle was chairman of the Irish Institution of Civil Engineers for two years, and he had filled the chairmanship of the Dublin Branch of the Institution of Electrical Engineers. The salary attached to the office which he has vacated is £750 per annum, with a war bonus of £150.

St. Helens Town Council on Wednesday confirmed a decision of the Electricity Committee, appointing Mr. B. T. HAWKINS chief electrical engineer, in the vacancy created by the resignation of Mr. E. M. Hollingsworth, the salary to be £500 per annum. It was also decided that the staff at the electricity works be re-arranged, with increases, as follows: —Mr. C. E. Green to be mains superintendent (£300), Mr. F. N. R. Baker station superintendent (£300), Mr. H. C. Duncan chief clerk (£260), Mr. H. J. Greer, motors and installation inspector (£250), the salaries to be paid without any bonus. Various increases of salary were granted to the office staff of the Electricity Committee. Mr. E. M. Hollingsworth, who is taking up work under the United Alkali Co., has been retained by the Tramways Committee in an advisory capacity for six months at a fee of £200. This is in connection with the negotiations for the transfer of the tramways from the company to the Corporation.

General.—The *Manchester Guardian* states that Lieut.-Col. LINCOLN CHANDLER, who, as mentioned here last week, has resigned the managing directorship of the British Westinghouse Co. at Trafford Park, has been co-opted on the general board of the company. A portion of the 10 per cent. cum. pref. share scrip created under the recent reorganisation of capital was being offered to the employés last week for subscription under easy-payment terms.

Mr. T. W. SHAW has joined the staff of Messrs. Cunningham, Ltd., and will have charge of their motor repair department.

Mr. J. A. WOODS has resigned his position as chief engineer to the Newcastle Breweries, Ltd., and has joined the staff of the British Electrical & Manufacturing Co., of 2, St. Nicholas Buildings, Newcastle-on-Tyne, Sunderland, and London.

Ald. A. R. JEPHCOTT, the new M.P. for the Yardley Division of Birmingham, is chairman of the Birmingham Corporation Electric Supply Committee.

Swansea Corporation Electricity Committee has elected Col. ALEXANDER SINCLAIR chairman, and Ald. JAMES vice-chairman, of the Committee for the ensuing year.

Mr. E. L. SHEPHERD, who has been with the Midland Electric Corporation for Power Distribution, Ltd., Ocker Hill, Tipton, for between six and seven years (and previously for five years at the St. Helens generating station), has resigned his position in order to become electrician on the outside staff of the electric crane and lift department of Messrs. Holt and Willetts, of Cradley Heath.

Mr. W. E. CRAWLEY, who has been connected with Messrs. Ferranti, Ltd., for 27 years, has now been appointed their sales representative for meters and instruments in the South of England. Mr. Crawley's district will not include the London telephone area, as clients in that area are already being attended to by the company's London branch office.

Messrs. G. DUNCAN MANN, S. E. SHEERMAN, and F. R. PENDERGAST have resigned their positions as sales managers in the Midland Counties for Messrs. Veritys, Ltd., with whom they had over 57 years' combined service, and are now trading as the United Electrical Co., at Newhall Chambers, Newhall Street, Birmingham. They have been appointed sole selling representatives in the Midland Counties by Messrs. S. G. Leach & Co., Ltd., London, and are also representing Messrs. Wright & Wood, of Halifax.

A Nottingham paper states that Sir JOHN SNELL, having taken up a Government appointment, is unable to advise the combination of the local authorities of Nottingham, Derby, Leicester, Mansfield, and other East Midland towns on the question of electric power supply. It is, therefore, proposed to retain his partner, Mr. RIDER, in his place.

We are asked by Mr. A. G. COOPER, M.I.E.E., to let it be known that he is not the Mr. F. G. Cooper, of Colne, who, as stated in our last issue, has accepted a position at Sheffield. Mr. A. G. Cooper left Colne, where he was borough electrical engineer, in July last, and joined the Inventory Staff of the Engineering Department of the Ministry of Munitions at Manchester, where he is now employed.

Mr. C. M. FERGUSON has rejoined the staff of Messrs. James Gordon & Co., of Queen's House, Kingsway, W.C. 2, in charge of their steam power department, where he will be pleased to see old friends.

Mr. J. F. MCENTEE, who has been elected M.P. for South Monaghan in the Sinn Fein interest, was appointed assistant electrical engineer under the Dundalk Urban Council in 1914. He took part in the Irish rising of Easter Week, 1916; was tried in respect of the murder of a policeman and acquitted; was deported and released, but was re-arrested, and is among the Irish leaders now interned in England.

War Honours.—The following gentlemen, to whom the ELECTRICAL REVIEW offers its congratulations, appear in the lists published yesterday of those who have been appointed to, or promoted in, the Order of the British Empire for war services:—

Mr. C. L. Budd, C.B.E., member of the Non-ferrous Materials Department of the Ministry of Munitions, Mr. J. McLaren (chairman of J. & H. McLaren, Leeds), Mr. W. Thom (director of Yates & Thom, Blackburn), and Mr. John Wormald (managing director of Mather & Platt, Ltd.), are made *Knights Commanders* (*Civil Division*).

Mr. G. H. Banister (Vickers, Ltd.), Major J. L. Benthall (Vickers, Ltd.), Principal J. C. M. Garnett, of Manchester, Mr. G. E. Chadwyck-Healey (Director of Materials and Priority, Admiralty), Mr. W. W. Lackie (city electrical engineer, Glasgow), Mr. D. S. Marjoribanks (Sir W. G. Armstrong, Whitworth & Co.), Mr. S. L. Pearce (city electrical engineer, Manchester), Mr. R. P. Sloan (managing director, Newcastle-on-Tyne Electric Supply Co., Ltd.), become *Commanders* (*Civil Division*) *in the Order*.

There is also a lengthy list of Officers and Members.

The Order of the British Empire has been conferred on Mr. GEORGE WEBSTER, manager of the Rochdale Corporation tramways, for work in connection with the war. Mr. Webster was for two years the hon. secretary of the Rochdale Shell Factory, and was afterwards elected a member of the board of directors.

Second-Lieutenant H. HOPKINSON, R.A.S.C., whose name appears in the list of M.B.E. (Military Division) of the Army Honours, and also in Sir Douglas Haig's dispatch dated November 8th, 1918, was sales engineer to the Walsall corporation electric supply department.

Congratulations to Brigadier H. W. THORNTON, R.E. (T.F.), manager of the Great Eastern Railway, on his appointment as K.B.E. (Military Division).

Roll of Honour.—More than a year ago we announced that the Military Medal had been awarded to Lance-Corporal J. A. BARLOW, an employé in the public lighting department of the Stepney borough electricity undertaking. Lance-Corporal Barlow has now been awarded a bar to his Military Medal for further conspicuous bravery in action. The official reference to the matter reads:—

> Under very heavy shell fire at Klein Zillebeke, on September 30th, 1918, this N.C.O. went to the assistance of a party of men and pack mules who had all been either killed or wounded. Without any assistance he got all the wounded to a place of safety and dressed them, and remained with them until the arrival of stretcher-bearers to remove them. By his action he undoubtedly saved the lives of the wounded men. He showed great courage and tenacity of purpose, and absolute fearlessness, and is at all times a cheerful and willing soldier.

Private J. NELSON, Manchester Regiment, who has died from influenza whilst a prisoner of war in German Poland, was employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

Private J. HARDMAN, 6th Manchester Regiment, reported as having died in a German hospital, and Corporal W. J. CAWLEY, Royal Welsh Fusiliers, killed, were both employés of the British Westinghouse Co., Ltd., Trafford Park.

Private W. LONSDALE, West Riding Regiment, formerly a tram driver in the employ of the Leeds Corporation, who was condemned to death for striking a sentry while a prisoner of war in Germany, arrived home on Saturday last.

Obituary.—MR. J. R. HECKLEY.—The death occurred on January 3rd at Sheffield, suddenly, of Mr. J. R. Heckley, of Messrs. Vickers, Ltd. The deceased gentleman had been with the company for 50 years, latterly as secretary.

COUN. RICHARD HOLT.—We regret to announce the death of Coun. Richard Holt, J.P., Chairman of the Blackpool Electricity and Tramways Committee, which took place on Friday, 3rd inst. Coun. Holt, who was also Deputy-Mayor, had been a respected member of the Blackpool Town Council for some 17 years. During his public career he had always worked hard for the well-being of Blackpool, and his loss will be keenly felt by many of the public bodies of the town. He was held in the highest esteem by everybody, and the electricity and tramway department in particular has been deprived of the services of a chairman who was everything that could be desired.

MR. L. E. HORRELL.—The death has occurred from injuries sustained through being run over by a taxi-cab, of Mr. Louis Edwin Horrell, electrical engineer, of Garsington (Oxon.). He was 37 years of age, and was on the staff at the Milton power station.

MR. EDWARD JACKSON.—The funeral took place on Saturday, at Barnt Green, near Birmingham, of Mr. Edward Jackson, a director of the Midland Railway Carriage and Wagon Co., who had been for 60 years identified with that concern.

NEW COMPANIES REGISTERED.

Electricars, Ltd. (152,477).—Private company. Registered January 2nd. Capital £15,000 in 100,000 7 per cent. cum. pref. participating shares of £1 each and 300,000 ord. shares of 1s. each. Manufacturers of and dealers in carriages, omnibuses, trucks, tractors, lorries, locomotives, tramcars, motors, vehicles, submarines, launches, boats, barges, &c., and especially those using storage batteries for motive power. The subscribers (each with one pref. share) are:—Brig.-Gen. H. C. L. Holden, 2, St. John's Park, S.E. 3; J. G. Mommer, 12, Grove End Road, N.W. 2, engineer; C. T. D. Burchall, 5, The Sanctuary, S.W., solicitor; A. W. Burchall, 5, The Sanctuary, S.W., solicitor; J. K. Christie, 14, Colville Road, W. 11, clerk; J. A. Braik, 20, Cambridge Road, S.W. 19; C. Vines, 178, Venner Road, S.E. 26, solicitor's managing clerk. No persons had consented to act as directors to January 2nd. Registered office: 2-3, Duke Street, St. James's, S.W. 1.

Engineering Publications, Ltd. (152,498).—Private company. Registered January 3rd. Capital, £1,000 in £1 shares. To enter into an agreement, the parties to which are not named; in the articles as originally printed this was stated as an agreement with R. V. O. H. Lash or Lush, but the name has been erased. To carry on the business of publishers and proprietors of newspapers, journals, magazines, books, and other literary works, printers, stationers, advertising agents, &c.; also to establish competitions and insure (gratuitously or otherwise), or arrange for the granting of free insurances. The subscribers (each with one share) are:—J. E. Passmore, 8, Parkside Avenue, Wimbledon, printer; H. Randall, Earnshaw Cottage, Esher, Surrey, proprietor, Royal Worcester Warehouse Co. First directors: H. Randall and J. E. Passmore, each of whom may retain office while holding 20 shares. Registered office: 30-4, Chancery Lane, W.C.

Electric Tapes, Ltd. (10,185).—Private company. Registered December 23rd in Edinburgh. Capital, £6,000 in £1 shares. To carry on the business of manufacturers of and dealers in rubber, asbestos, and insulating materials. The subscribers (each with one share) are:—J. C. Sinclair, 47, Waterloo Street, Glasgow, rubber and asbestos manufacturer; A. J. Terry, 3, Haydon Street, Minories, E.1, rubber and asbestos manufacturer. First directors: J. C. Sinclair and A. J. Terry. Registered office: 47, Waterloo Street, Glasgow.

George England, Ltd. (152,455).—Private company. Registered January 1st. Capital, £4,000 in £1 shares (500 7½ per cent. pref.). To take over the business carried on at Walton-on-Thames as George England, and to carry on the business of manufacturers of electrical, steam, gas, or other motor vehicles and aircraft; aerodrome, aero school and club, hangar, garage, and shed proprietors, &c. The subscribers (each with one share) are:—F. H. Aarons, The Firs, Fir Road, Kenley, Surrey, solicitor; L. P. Potter, 28, Brookfield West Hill, Highgate, N.6, solicitor. First directors: G. England and E. C. G. England. Registered office: Broad Street House, E.C. 2.

CITY NOTES.

Blackpool, St. Annes & Lytham Tramways Co.—The balance sheet shows liabilities on the 5 per cent. debenture stock and interest accrued to date, £197,375. On the revenue account, the items show traffic expenses £11,048, general expenses £4,504, general repairs and maintenance £13,184, power expenses £5,274. The traffic receipts (less £20,993 paid to Blackpool Corporation) amounted to £63,620. A profit of £10,348 was made. £7,500 was paid in interest on debenture stock, and £1,500 to sinking fund. The adverse balance was reduced from £40,433 to £39,085

Direct United States Cable Co., Ltd.—Interim dividend 2s. per share (4 per cent. per annum), less tax at 6s., for the quarter.

Marconi International Marine Communication Co., Ltd.—Interim dividend of 5 per cent., being 1s. per share, less tax at 5s. 9d.

Bell Telephone Co. of Canada.—Quarterly dividend 2 per cent., less tax.

Anglo-American Telegraph Co., Ltd.—Balance dividend of £1 10s. per cent. on the consolidated ordinary stock for the year, less income-tax at 5s. 10½d. Balance dividend of £1 10s. on the preferred stock, less income-tax at 6s. First and final dividend of £1 10s. upon the deferred stock, less income-tax at 5s. 9d. These dividends, together with those already paid, will amount to £3 15s. per cent. on the consolidated ordinary stock, £6 per cent. on the preferred stock, and £1:10s. per cent. on the deferred stock for the year 1918. A bonus of 1s. 9d. per cent. is to be paid on the undivided ordinary stock, and 3s. 6d. per cent. on the deferred stock, free of income tax.

Companies Struck off the Register.—The following companies have been struck off the register, and are accordingly dissolved :—

Contractors' and Engineers' Publications, Ltd.
Dickson Corthesy Steam Turbine Developments, Ltd.
Efficient Heating & Ventilating Co., Ltd.
Harvey Electro-Chemical Co., Ltd.
High-Speed Printing Telegraph Co., Ltd.
Kentish Town Motor & Electrical Engineering Co., Ltd.
Mid-Sussex Electric Light & Power Co., Ltd.
North-Eastern Electric Smelting Co., Ltd.
Radium Electro Emanation Co., Ltd.
Telephone Accessories Co., Ltd.

Chile Telephone Co., Ltd.—Interim dividend 6 per cent. per annum, free of tax, on ordinary shares for the half-year.

London United Tramways, Ltd.—Meetings are to be held on January 23rd of the preference shareholders and the debenture stock holders to consider a scheme of arrangement.

Victoria Falls & Transvaal Power Co., Ltd.—Dividend for six months on the preference shares at the rate of 6 per cent. per annum, less tax.

Kaministiquia Power Co.—Dividend at the rate of 8 per cent. per annum for the quarter.

STOCKS AND SHARES.

Tuesday Evening.

Military and civil unrest had a dullish effect upon Stock Exchange markets, and, in particular, has made Home Railway stocks heavy. The industrial sections are, however, in considerable favour, and even those which were at first weak on the signature of the Armistice are now recovering, and enjoying, their full share of popular support. Evidently not all the money in the country is going into diamonds and other precious-stone investments, because the provinces are substantial buyers in the Stock Exchange. When Treasury restrictions are relaxed in regard to new issues, there will be a rush, judging from present experience, for anything good enough to offer the public a fair channel for money.

Labour troubles started early in the new year on the Brighton Railway, and the electrified portion of the Lancashire and Yorkshire Railway. That it might spread to a much wider circle afforded reason for putting down prices of Home Rails. The outstanding exception of strength is still the Underground Electric Railways of London income bond issue, the price of which has risen 1½ further to 9¼ on the hope of the dividend getting nearer to the full 6 per cent. distributed in 1916. As the coupons are paid free of tax, the 6 per cent. would be equal to 8½ per cent. gross, and although it may be rather optimistic to expect the present 4 per cent. to jump 50 per cent. next month, the conditions of travelling point to an early increase over the former rate. The other purely electric railway stocks are about the same as they were. London Electric shares are higher at 4, and Underground £10 shares rose to 3½. It may be mentioned, in passing, that the details of the United States electrically-propelled battleship *City of Mexico* have aroused mild interest in the Stock Exchange.

While there is not much business doing in the shares of home electricity companies, Bromptons have risen ½ to 7⅞, and City of London at 13½ are the fraction better, while other recent rises have been fully maintained. South Metropolitan preference hardened to a guinea. The manufacturing shares are also firm. Attention may usefully be called to the misleading character of some of the titles of electricity issues in the Stock Exchange Official List. For example, Edison-Swan 5 per cent. debenture stock is still called 4 per cent., and General Electric preference, the dividend on which was recently raised to 6½ per cent., are retained in the list as being 6 per cent. shares. Other instances might be cited, and, in spite of the protests which have been lodged to the appropriate department of the Stock Exchange which attends to these matters, nothing has been done to put them right. By way of protest, certain of the quotations have been withdrawn altogether, the dealers refusing to supply them, on the ground that while titles are wrong, it is useless to give prices. No doubt the Stock Exchange officials are suffering, like everyone else, from shortage of staff and other war conditions, but the necessary alterations are so slight, and yet so important, that it is high time they should be made.

A considerable business has been done during the last few days in the 6 per cent. cumulative preference shares of the North Metropolitan Electric Power & Supply Co. The company is in a good financial position, and, although the war conditions necessitated a reduction of the 12 per cent. dividend paid in 1913 and 1914 to 10 per cent. for the three succeeding years, it is not at all unlikely that the 12 per cent. will be resumed before long. The preference dividend is well covered, and at 18s. the yield works out to £6 13s. 4d. per cent. on the money, dividends being due on April 30th and October 31st.

Telegraphs and Telephones have regained their firmness, and advances have been secured by Eastern Extensions, Westerns, Eastern Telegraph ordinary stock, Globe preference, and one or two others. Great Northern Telegraphs, however, have lost 10s. at 32½. Callenders continue to rise, and are 5s. up at 10½. Marconis have gone back to 4½, and Americans are a little easier at 30s., Marines being quoted 3½. Amongst other manufacturing shares, Babcocks at 3½ are 1/16 harder, Edison-Swans at 15/16 are 1/16 lower. A demand has arisen for Edison "B" shares, which were supposed to be about 3d., until a buyer of several thousand shares came along and found that he could not get them, even with a bid of 1s. a share.

In the foreign group there are no changes to record, with the exception of a point fall in Mexican Light preferred shares, which has reduced the price to 48. Mexican issues generally are, however, a goodish market, and much is expected from the probable action of the United States Government as soon as the American troops have mostly returned home. There is a disposition to buy Brazilians, but enterprise is somewhat curbed by the slight feeling of dulness that has spread over markets by reason of the labour difficulties at home, together with the news from Russia. A sharp fall in the price of copper, the metal, had no effect upon prices of the companies connected with it. The rubber market is better, and a feature of the past few days has been resumed buying of armament shares, a movement that has sympathetically influenced prices in the iron, coal, and steel section.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Jan. 7, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7⅞	+ ½	£6 15 7
Charing Cross Ordinary	5	4	3½	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	3½	—	6 13 4
Chelsea	3	5	4	—	6 5 4
City of London	8	8	13½	+ ½	6 0 9
do. do. 6 per cent. Pref.	6	6	10½	—	5 15 5
County of London	7	7	11½	—	6 5 7
do. do. 6 per cent. Pref.	6	6	10½	—	5 15 5
Kensington Ordinary	6	7	8½	—	5 19 2
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	6	4	—	6 5 0
Metropolitan	3	4	3	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	8½xd	—	6 15 6
St. James' and Pall Mall	8	9	7½	—	6 0 4
South London	5	6	8	—	6 13 4
South Metropolitan Pref.	7	7	21/-	+6d.	6 13 4
Westminster Ordinary	7	9	7½	—	6 4 4
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	1½	23½	—	6 7 6
Chile Telephone	8	8	7⅛	+ ⅛	5 5 0
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	5	5	15½	+ ½	*5 2 5
Eastern Tel. Ord.	9	8	158½	+1	*5 1 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 8
do. do. Pref.	6	6	10½	+ ½	5 14 3
Great Northern Tel.	24	29	32½	— ½	6 15 0
Indo-European	13	13	58½	—	5 17 0
Marconi	15	20	4⅜	— ⅛	4 6 6
Oriental Telephone Ord.	10	10	9½	+ ½	4 0 0
United R. Plate Tel.	8	8	8	+ ½	*5 0 0
West India and Panama	6d.	1/3	1⅛	—	*3 12 6
Western Telegraph	8	8	16⅜	+ ⅛	*4 16 8
Home Rails.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan		1	31	— ½	3 4 6
do. District	Nil	Nil	26	—	Nil
Underground Electric Ordinary	Nil	Nil	3½	+ ⅛	Nil
do. do. "A"	Nil	Nil	9/9	—	Nil
do. do. Income	6	4	94	+1½	*4 5 1
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	42	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	4½	—	—
do. do. 2nd Pref.	5½	—	3½	—	—
do. do. 5 Deb.	5	5	74½	—	6 14 8
Brazil Tractions	—	—	57	—	—
Bombay Electric Pref.	6	6	102	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	67½	—	7 11 5
do. do. Preferred	Nil	Nil	50	—	Nil
do. do. Deferred	Nil	Nil	45	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds	Nil	Nil	83½	—	Nil
Mexican Light Common	Nil	Nil	32	—	Nil
do. Pref.	Nil	Nil	48	—1	Nil
do. 1st Bonds	Nil	Nil	70	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	90	+ ⅛	3 0 0
British Aluminium Ord.	10	10	1⅜	—	5 8 1
British Insulated Ord.	20	20	22	—	4 9 0
British Westinghouse Pref.	7½	7½	23	—	6 0 0
Callenders	20	25	10½	+ ½	5 19 1
do. 6½ Pref.	5	5	6xd	—	5 2 4
Castner-Kellner	22	20	9xd	—	5 18 6
Edison-Swan, "A"	—	—	4⅜	+ ⅛	3 0 0
do. do. 4 per cent. Deb.	4	4	74½	—	5 7 0
Electric Construction	7½	10	1⅜	—	3 0 0
Gen. Elec. Pref.	6	6	10xd	—	*6 5 4
do. Ord.	10	10	17½	—	*5 19 5
Henley	20	25	3½	—	5 11 3
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	11xd	—	*3 17 8
Telegraph Con.	20	20	48	—	*5 0 0

*Dividends paid free of Income Tax.

WALTER RATHENAU ON THE GERMAN SITUATION.

An Alleged Average of £7 per Week in the Berlin Engineering Trade.

Some remarkable speeches have been delivered by Herr Walter Rathenau, chairman of the A.E.G., during the course of the war, but now that the Germans have been defeated the tone of his observations has completely changed. In the course of a recent interview with the representative of a New York newspaper, the chairman expressed the opinion that "Germany is ruined for several generations; ruined politically, industrially, and economically." This purely political statement has been made for American consumption, no doubt, in the hope that it may exercise the desired political effect in the United States. On the other hand, the speech which Herr W. Rathenau made before the shareholders at the recent general meeting was intended not only for home consumption, but also for that of Great Britain and her Allies. An abstract of the speech is given below, and one of the most noteworthy statements therein is the remark that with the adoption of the 8-hours' day the wages of the mechanics and engineers in the district of Berlin now amount to about £7 per week. The abstract is as follows:—

Herr Rathenau stated that on the last occasion when he addressed them they were on the eve of the Russian peace offer. At that time he remarked that they could assume that the war had entered into liquidation, and he added that he wished no "final calls" would be made in connection with the liquidation. It would have been impossible for him to have expressed himself more distinctly, although it might be that his observation had not been listened to. In the meantime, the most serious "final calls" had been made upon them, and they would have have great difficulties in settling them. The directors had estimated the dangers and the duration of the war quite seriously, and had not withheld the estimate from the shareholders. They had never entertained optimism, but had regarded it as their duty to serve the country as well as they were able, and keep their plant at the disposal of the country. They had not accepted war contracts in order to earn war profits, but in order to protect their fighting front. In the interval a great revolution in the country had taken place. The directors had welcomed the revolution, and believed in the new realm; they believed in the possibility of a changed order of things. They were willing and ready, in community with all orderly forces, to co-operate in the reconstruction of the country. In order to strengthen their opinion, and to show they believed in the order and the constancy of circumstances in connection with the character and the convictions of the German nation, they had decided to recommend the payment of the Peace rate of dividend. They would have to reckon in the future that the fate of the company, as well as the destiny of the entire German industry, would no longer depend solely upon economic opportunities, but predominatingly on political events.

Much had been said recently concerning the nationalisation of industries—catch-words and general theories being largely brought into play. It was possible, he said, to organise industries so that an increased participation in them could be granted to all parties, workmen and officials in particular, both in the material results and in the determining controlling factors of the community. But the supposition for any new order was a condition which would augment the productiveness of industries. It was impossible to place increasing burdens on their industry, according to general political wishes, and leave the future to chance as to whether the industry could, or could not, bear these burdens. The first problem was the development and expansion of productiveness, and the speaker failed to see any fruitful proposals in that direction in the public discussions. He believed in the possibility of increasing productiveness and its efficiency if they excluded the losses through friction to which they were subject at present. The losses in material, transport, and labour could and must be overcome. In contradistinction to this idea, however, the burdens were growing provisionally in such a measure that they could only be borne with great difficulty by all industries, but could no longer be borne by the Berlin engineering industry in particular. The Berlin manufacturers might be reproached for having been too yielding in regard to the demands made upon them by officials and workmen. The speaker believed, however, that it had been well to follow the policy of conciliation which had been pursued in Berlin, in so far that it had been said that peace in industry should be maintained at the seat of the Government in these times of crises in favour of the general community.

It could not be concealed, however, that against these sacrifices had to be set provisionally a weakening of their productiveness. It was easy to calculate what that meant when the wages of workmen to-day, reckoned on the eight-hours' working day, were said to amount to over 7,000 marks (£350). That implied, with a number of workmen which the speaker would only estimate at 300,000 in Berlin, a charge upon their national income of £100,000,000. It was obvious that such a burden could not be demanded permanently by a comparatively small section of the population, as the entire national income amounted to £1,750,000,000. It was necessary to keep in view, and say to the public without reserve, that the growing demands meant not only serious economic dangers, but also serious political dangers. They must be clear on the point that the aversion to Berlin was growing. If Berlin, as it seemed, came out of the ranks in so far that wages were granted there which could not be obtained in the country, the aversion to Berlin would not disappear, but increase; and the dangers of a separatory division of the country would not decrease. At the same time, however, it would be a serious danger to German economic life if the great Berlin industry were to be so far weakened as no longer to form the factor which it constituted in the whole economy.

The chairman further remarked that exaggerated demands made by those at present employed in the engineering works in Berlin were a disadvantage to the returning soldiers. If now, and so long as the companies were able to bear them, the wages of the individual were so much increased that a general decline and a reduced efficiency of the works awaited the returning men, the latter would seriously complain that in their absence the works had been so weakened as to leave no work for them to do. The country was faced not only with internal economic dangers, but also with the conclusion of a peace which they did not know and which might place upon them enormous burdens. One thing alone could help them in such times: orderly reconstruction of industry in the sense expressed by the speaker—namely, the extension of productiveness and the most complete solidarity of all operating factors in the country—between employers and workmen and between all professional classes.

ELECTROTHERMIC PROCESSES.

As a science electrothermics has been the means of developing several distinctive types of electric arcs, and has indicated methods of chemical synthesis and decomposition. Thus many new compounds and metals have been discovered and commercialised, while several products have been manufactured better and cheaper in the electric furnace than in the previously used fuel-fired furnaces. It will therefore be of interest to briefly consider a few typical processes, the following particulars being taken from the *General Electric Review* of November, 1918.

Calcium Carbide (CaC_2).—Calcium carbide was one of the earliest commercialised electric furnace products. The formation is represented by the reversible reaction shown in (*a*); simultaneously the two side reactions shown in (*b*) and (*c*) occur. In each case, as the temperature is raised the reaction proceeds to the right.

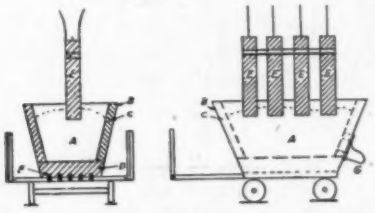
(*a*) $CaO+3C=CaC_2+CO$

(*b*) $CaC_2=Ca+2C$

(*c*) $CaO+C=Ca+CO$.

The charge consists generally of good quality lime (56 parts) and low ash (under 3 per cent.) anthracite (36 to 39 parts), crushed to pieces one or two inches in diameter. Coke is generally used. Phosphorus should be avoided and the sulphur kept low.

The product is not pure CaC_2, which in reality is a colourless, transparent substance, but is a dark grayish-black



A, charge; B, steel shell; C, brick lining; D, carbon and tar hearth; E, electrode bundle; F, steel grating; G, tapping hole.

FIG. 1.—CALCIUM CARBIDE FURNACE OF THE TAPPING TYPE.

crystalline material, containing about 15 per cent. lime and carbon, and also impurities in small amount retained from the original charge.

Calcium carbide furnaces are all of the arc type, but vary greatly in capacity and in the method of operation. A furnace of the tapping type is shown in fig. 1. In order to supply the large currents used (28,000 amperes at 50 volts) it is customary to use a bundle of electrodes. A carbon-tar mixture is tamped in the bottom over some steel grate bars, forming a conducting hearth. The electrode contacts are water-cooled. Each unit is mounted on wheels and a tap hole is provided for drawing the sluggish molten carbide. Some furnaces of similar construction do not possess the tap hole, in which the operation is intermittent, the charge being removed after solidification. The furnace used for a time by the Union Carbide Co. at Niagara Falls is of quite different construction from the others. It is called the continuous type furnace and is shown in fig. 2. It consists essentially of two slowly revolving concentric drums. The furnace makes about one-third revolution per day. The outside plates are removable where the electrodes enter, and at the point where

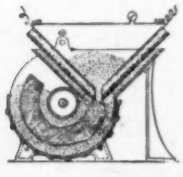


FIG. 2.—CONTINUOUS TYPE CALCIUM CARBIDE FURNACE.

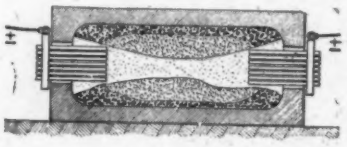


FIG. 3.—CARBORUNDUM FURNACE.

the sufficiently cooled carbide is broken up and taken out. At other points the plates hold the charge in place. The end plates are fixed. Only single-phase furnaces have thus far been mentioned, but large three-phase units of 7,000 H.P., 45,000 amps., 80 to 100 volts, are in operation in Europe. The energy required to produce calcium carbide varies from 1.7 to 2 KW.-hour per pound.

Carborundum (SiC).—The chemical reaction resulting in the formation of carborundum is generally represented to be $SiO_2+3C=SiC+2CO$. Tone, of the Carborundum Co., however, claims it is to be formed in the following manner, from the silicon and the carbon monoxide vapours that are present: $3Si+2CO=SiC+SiO_2$. It probably is formed in varying degree by both reactions. In addition to the production of carborundum, monox (SiO), silicon, siloxicon ($Si_x C_x O$) and graphite are formed under suitable conditions. All of these reactions are reversible.

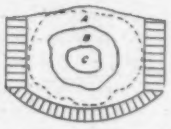
$SiO_2+2C=Si+2CO$

$SiC=Si+C$ (graphite)

$SiO_2+C=SiO+CO$.

The carborundum furnace charge is generally represented to be (in percentage parts by weight) thus:—

Sand 51.2 per cent., coke 35.4 per cent., sawdust 10.6 per cent., salt 1.8 per cent. The sand is ground silica 99.5 per cent. pure. The sawdust is used simply to give porosity to the charge in order to allow the carbon monoxide an opportunity to escape freely. The salt reacts with some of the impurities, forming volatile chlorides. Coke, or ground material from a previously used charge, is used as a conduct-



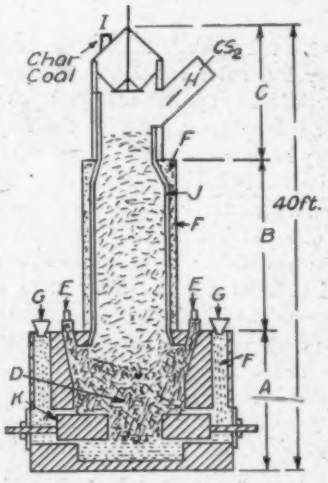
A, uncrystallised carbide; B, carborundum; C, carbon core.

FIG. 4.—TRANSVERSE SECTION OF FURNACE SHOWING RELATIVE POSITIONS OF CONTENTS AFTER RUN.

ing core around which is packed the new charge. The core and charge are built up on a permanent foundation with replaceable sides of brick. Connection between core and electrodes is made by means of finely ground coke powder.

The standard furnace consumes some 2,000 H.P. It requires about 250 volts at the start, but at the end of a run only 75 volts, when it takes 20,000 amperes. The temperature of the core may reach 3,000 deg. C., but the zone in which the carborundum is formed (next to the core) should be between 1,820 and 2,220 deg. C., the temperatures at which the carbide begins to form and to decompose. The largest furnaces are 30 ft. long, and yield about 7½ tons of carborundum. After a furnace run, the products of the reactions are found located in the order and approximate proportions as represented in figs. 3 and 4.

The siloxicon compounds are inferior to carborundum in quality, and do not find very extensive applications. They are formed in the furnace in the annular zone outside of the carborundum, where the temperature is not high enough for the formation of the carbide.



A, hearth; B, shaft; C, head; D, charge of charcoal; E, opening for feeding broken carbon to serve as conductor; F, sulphur; H, opening for conducting off carbon bisulphide gas; J, annular space filled with sulphur; K, carbon electrodes.

FIG. 5.—CROSS-SECTION OF THE TAYLOR CARBON BISULPHIDE FURNACE.

Silicon.—While it is possible to manufacture silicon in a resistance furnace, as indicated in the carborundum furnace reactions given above, the method is not practised commercially. Instead, a furnace of the arc type, using a charge of sand (SiO_2) and coke (C) is used. $SiO_2+2C=Si+2CO$. The Carborundum Co. taps a 650- to 900-lb. pig every few hours. The grades made contain from 90 to 97 per cent. Si. The furnace is built of fire brick with a carbon lining, and consumes about 1,200 H.P.

Graphite.—Graphite is made in a resistance furnace, very similar in form to the carborundum furnace. The present furnaces for graphitising carbon in bulk possess a central

core, surrounded by the charge mixture of granulated coke, or of anthracite, or of petroleum coke, together with the catalyser, iron oxide. In some cases, the ash from the anthracite or coke will catalyse the reaction. At least 1 to 2 per cent. of Fe_2O_3 is required.

A great proportion of the Acheson graphite is made into electrodes. These are graphitised from the molded mixtures of carbon binder and catalyser, compressed into shape under high pressure. The carbon electrodes are loaded in a series of piles in the furnace, spaces between piles being filled with ground coke to increase the resistance.

In the conversion of the bulk graphite about 90 per cent. of the charge is changed over. All of the charged electrodes are converted. The furnaces compare in size with the carborundum furnaces, the largest consuming 1,000 H.P. At the end of the run (20 to 24 hours) about 9,000 amperes at 80 volts are passing. The product resulting from the high temperature treatment is quite pure (99.9 + per cent. C.) due to the volatilisation of the impurities.

Carbon Bisulphide (CS_2).—The electrothermic manufacture of carbon bisulphide well demonstrates the advantages of electric heat, and employs a most ingenious furnace. It is said that the original furnace was operated for the first two and one-half years with but one shut-down for cleaning. A cross-section of the furnace is shown in fig. 5. It is 40 ft. high.

The reaction consists in the union of sulphur (volatilised and highly heated by an electric arc) with incandescent coke, according to the equation $C+2S=CS_2$. The coke is fed in through the head of the furnace at I at such a rate as to keep the shaft B well filled. The sulphur is fed into the arc zone in molten condition, after being melted by waste heat of radiation in passing down the annular passages F outside both shaft and hearth. The CS_2 is cooled by heating the coke as it descends into the reaction zone, and is taken off through the furnace head at H, and condensed.

The heat is supplied by two-phase current, the arcs playing between two pairs of carbon electrodes placed 90 deg. apart. The space around and above the electrodes is filled with pieces of graphite, broken bits of carbon, &c. (D), to protect the electrodes (K), which are consequently subjected to very little wear. As the furnace walls are gas-tight no CS_2 vapours escape. About 4,000 amperes are supplied at 60 volts, and 0.52 KW.-hour per pound of CS_2 is required.

Fixation of Atmospheric Nitrogen.—Considerably more than 3,000 technical articles dealing with this problem have appeared to date. The difficulty of discussing the subject in a very few words is thus at once evident.

The methods of fixation depending upon the direct oxidation of atmospheric nitrogen are carried out in three different types of arc furnaces, all of which are in commercial operation. Though the furnaces are all of different types, there is no great difference in the yield of NO gases obtained.

Two other processes may be mentioned that are really chemical rather than electrochemical, although electric heat is used at points in each process, not because exceedingly high temperatures are required, but because temperature control is essential. The Serpek process fixes nitrogen through inter-action with alumina and carbon. The nitrogen comes from the air, the alumina from bauxite, and the carbon from coal which is heated with the bauxite to calcine it. The reaction temperature lies between 1,800 and 1,900 deg. C., and the reaction itself is $Al_2O_3+3C+N_2=2AlN+C3O$. The aluminium nitride is convertible into ammonia through treatment with steam, and the ammonia may be converted into nitric acid.

The Haber process causes nitrogen and hydrogen to unite directly through the agency of some catalytic agent, according to the reaction $N_2+3H_2=2NH_3$.

Leland L. Summers's comparison of power consumptions for the several processes is as follows:—

	Per lb. of N.
Direct oxidation of atmospheric N at 5 per cent. efficiency	30.0 KW.-hour
Cyanamid process—carbide 66 per cent. and cyanamid 99 per cent. efficiency ...	7.5 KW.-hour
Serpek process	5.5 KW.-hour
Haber catalytic process	0.7 KW.-hour

The reaction which results in the formation of NO, from O and N, is a reversible one, so that the concentration of the NO (which is small at best) is rigidly dependent upon the temperature, in accordance with the equilibrium law.

At the equilibrium temperature the oxide is decomposed as rapidly as it is formed above the equilibrium concentration. If the oxide once formed can be removed rapidly enough and cooled to 1,500 deg. C., further decomposition is slight. The commercial arc furnaces are, therefore, all designed to permit of the removal of the gases from the zone of high temperature as rapidly as possible. A rapid movement of air through the arc is required, resulting in the maximum temperature of the arc being unobtainable and a low efficiency for the process.

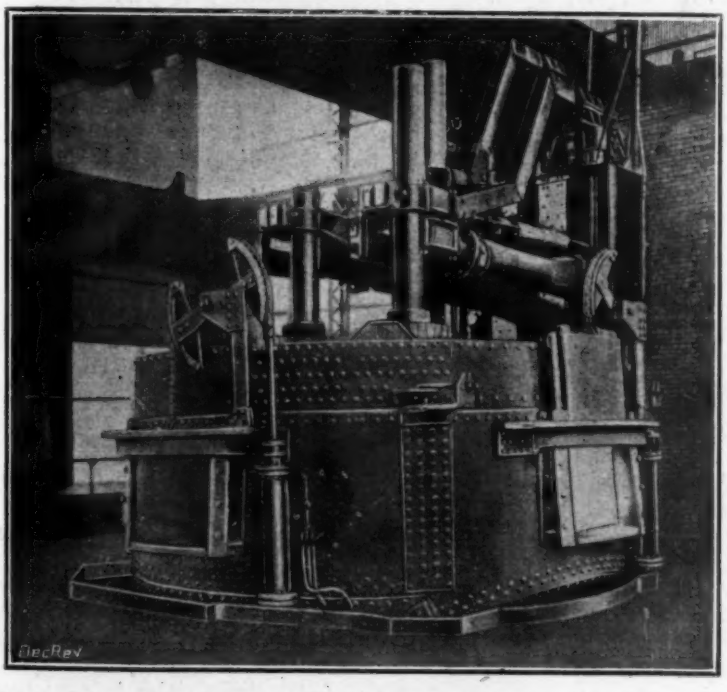


FIG. 6.—20-TON, 3-PHASE, HEROULT ELECTRIC-STEEL FURNACE FITTED WITH THREE 12-IN. GRAPHITE ELECTRODES.

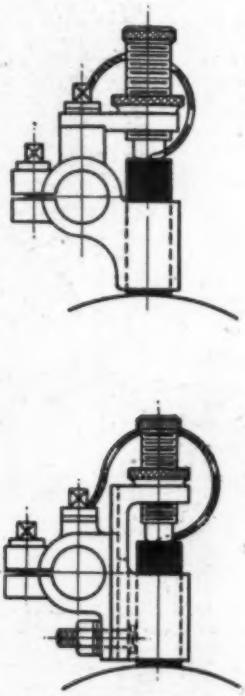
The Schonherr furnace gives the highest concentration of NO, but the Eyde furnace gives a little higher output of NO per KW.-hour. The electrode wear is very rapid in the Pauling furnace, and the slowest in the Eyde. The power factors are close on 70 per cent. for all furnaces.

CARBON BRUSH-HOLDERS.

By J. O. GIRDLESTONE, M.I.E.E.

I DO not think it necessary to make any apology for again bringing up the question of brush holders for motors and dynamos. It is just one of those details, frequently overlooked, which make all the difference between satisfactory running and the reverse. Motors of quite excellent design are often fitted with faulty brush holders, and the whole machine may be condemned for this imperfect detail.

It might be expected that with the large experience gained



FIGS. 1 & 2.—WESTMINSTER BRUSH HOLDERS FOR MOTORS AND DYNAMOS.

by makers, and the hundreds of thousands of machines in use, some standard pattern would have been evolved, but this is not so, although I am inclined to think that there is a distinct tendency to gravitate towards the type described below, which has now been in successful use for some years.

During the last eight or nine years many thousands of these holders have been supplied for all kinds of machines, from large turbo dynamos and alternators to small motors, and I do not know of any one case where they have been a failure. They can be made to suit practically any machine, but owing to lack of uniformity, cannot very well be stocked in standard sizes, and so have to be made up to suit requirements. The only dimensions required when ordering for any

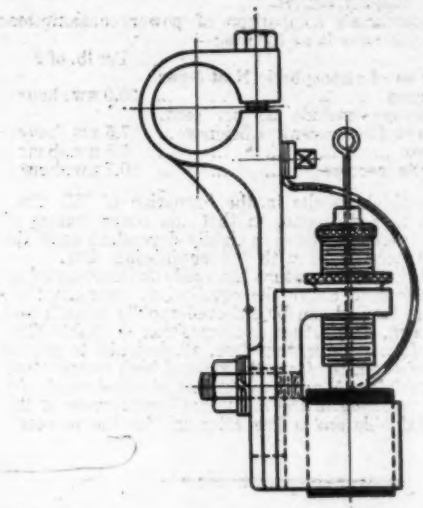


Fig. 3.—Heavy Brush Holder for Turbo-Generators.

particular machine are: Diameter of brush spindle, distance from centre of spindle to surface of commutator, number of holders required, and size of carbon brush.

It is advisable that the brush box be as close as possible to the commutator, allowing the brush to project about ¼ in. only. With the old type of swinging-arm brush holder flash overs were frequent, but there is much less risk of this occurring with the holder illustrated, the brush being but slightly in advance of the spindle.

In the holder as shown the brush is kept in intimate contact with the commutator by the spring enclosed in the tubular screw. A light pressure is found sufficient to prevent any tendency to jump, even when the commutator is slightly

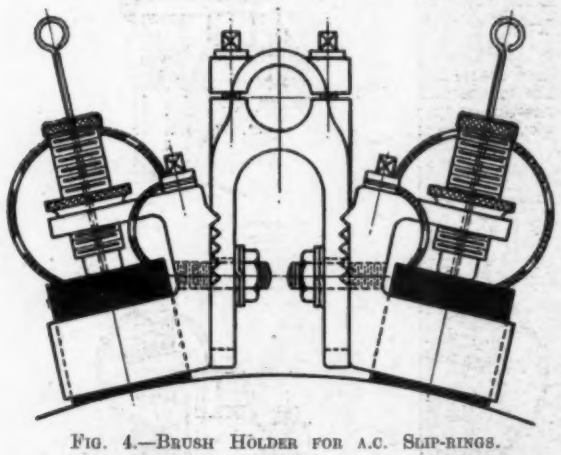


Fig. 4.—Brush Holder for A.C. Slip-rings.

out of truth, a condition fatal to most types of brush gear. The holders should be inspected at intervals to ensure that the brush is working freely in the box.

The illustrations show four brush holders made by the Westminster Engineering Co., Ltd.

Fig. 1 shows the ordinary type of holder for motors or dynamos; it consists of a gunmetal casting, the box part made an easy fit for the brush. The pressure is applied directly over the centre of the brush by means of a spiral spring inside the plunger which is itself a sliding fit in the adjusting screw. The spring is thus entirely enclosed and the pressure is exerted in a line passing directly through the centre of the brush.

Fig. 2 shows a similar holder, but with the box portion adjustable to allow for wear of the commutator. The sliding portion is secured to the fixed part by a nut and spring washer, and can be moved down as required.

Fig. 3 shows a heavier type of holder as supplied for turbines. The wire passing through the adjusting screw and spring permits the spring tension to be accurately measured by means of a spring balance. This holder is most substantially made, the plunger being generally of mild steel.

Fig. 4 illustrates the type generally used for A.C. slip rings, which type also has vertical adjustment. This pattern has been applied to a number of machines previously using copper brushes, with most satisfactory results. A copper-carbon brush is generally used in such cases.

CARBON BRUSHES: CONSIDERED IN RELATION TO THE DESIGN AND OPERATION OF ELECTRICAL MACHINERY.

At Birmingham, on December 18th, 1918, Mr. P. Hunter-Brown's paper (an abstract of which appeared in our issue of December 27th) was read and discussed before the South-Midland Centre of the Institution of Electrical Engineers.

Mr. A. T. Bartlett, in a written communication to the discussion, said he was much interested in the author's theory of air suction being the cause of the increase in the coefficient of friction at lower speeds; with perfect laboratory conditions it was quite conceivable that there might be a measure of "optical" contact, as it were, between the brush and the commutator, but this was not likely to be obtained in practice. He suggested another reason for the shape of the friction curve, which was that in practice brushes were not really in good contact all the time; at the higher speeds this imperfect contact was increased. He described an experiment he made some 12 years ago, when engaged on the commutation difficulties of direct-current turbo-generators. A commutator with all its segments connected to a common ring was mounted on a special shaft. The common ring was connected to a slip ring, so that current from an outside source could be passed into the commutator, and leave at the brushes pressing on the commutator in the normal manner. Very special attention was given to truth, surface, and balance of the commutator at full speed, and also to the bedding of the brushes. Readings were then taken with the following result:—One brush was first put down and loaded up to its normal current density, the drop was measured, which could be represented by unity. A second brush was then put down, and the current doubled in order to eliminate any effect of change of current density. The drop was then rougtly one-seventh. A third brush was put down with less change, the figure being then about one-fifth. He thought the only explanation was the one he had given, viz., that brushes were off the commutator for a considerable time, and this caused the retarding effect of the brush to be decreased. No doubt copper "picking" was due to electrolysis, but he thought that an irregular current distribution was more often the larger factor. Electrolysis, or a pseudo-electrolytic effect, undoubtedly occurred; he came across a really definite case some ten years ago. A heavy-current low-voltage generator was fitted with copper graphite brushes with a large copper content. On its trials, after running about 10 hours the commutator developed a salmon-coloured matt surface, and the brushes, if not the commutator, began rapidly to be transferred in the form of powder to the bed-plate and machine generally. The trial had to be stopped, and afterwards a careful examination of the brushes and commutator was made. The surfaces of the positive brushes were quite metallic and bright, whilst the negative brush surfaces looked as though they had been painted with dead lamp black. No trace of the copper content was visible; it had apparently been transferred to the commutator exactly as in normal electrolysis. The negative brushes were replaced with graphite brushes, and the machine then ran most successfully.

Mr. M. Kahn, in a written communication, said the following indicated the physical explanation of how current was transmitted from the brush to the collector. The voltage drop between collector and brush was comparatively constant over a large range of current density, and showed a minimum value below which no current passed. If one compared the curve for the drop in the author's fig. 1 with corresponding curves of electric arcs one found a great similarity. Another indication was the phenomenon called copper picking. On the face of it, this feature looked like an electrolytic action. A similar action was also found in the electric arc, the material of one electrode being carried in the direction of the flow of current to the other electrode. A third indication was the difference of contact drop between the positive brush and the collector and the negative brush. Mr. Hunter-Brown had not gone into that question. The phenomena mentioned showed that the flow of current from a carbon brush to a

collector differed entirely from the conduction of electrical energy along a metallic conductor. It seemed to take the form of a large number of minute electric arcs which were not visible to the eye. With increasing voltage between brush and collector, the energy in such arcs increased very much more than the voltage, as could be seen from the author's fig. 1. An increase from 2 to 2.5 volts doubled the current in the contact surface. An increase of voltage of 24 per cent. produced, therefore, an increase of energy of 250 per cent. The arcs became visible when the voltage between brush and collector was increased beyond a certain limit; they were, however, always present, although they might not be visible, wherever current passed between brush and commutator, and might cause wear, copper picking, and disintegration, even though the machine might appear to collect perfectly. It followed that the phenomenon of sparking depended on the voltage drop at any point between brush and collector, which could easily be proved by measuring that drop when sparking occurred.

Mr. W. N. KING said he noticed that no reference had been made to a well-known property of carbon which had an important bearing on the subject under discussion, viz., the negative temperature coefficient. Two prominent examples of this effect had come under his observation in large direct-current generators, one of 1,500 KW., and the other of 1,000 KW. capacity. In each case trouble was experienced with commutation at full load and over. Severe sparking, flashing, and overheating of the brushes occurred. One brush after another in a row would take more current than the others, and became red hot with cumulative effect due to the negative temperature coefficient, until the brush or flexible lead burned away. In one of the cases mentioned the trouble was eliminated by substituting Morganite "Link 3" for carbon brushes. It would be interesting to know whether the temperature coefficient of the Morganite brush was negative, and how it compared with carbon.

Mr. W. F. HIGGS said the author referred to atmospheric conditions in one or two places in the paper. The speaker knew of a 25-H.P. motor, 460 volts, the peripheral speed of the commutator being about 3,000 ft. per min., which was installed on two girders, 8 ft. above the floor, about two years ago. The brushes would run about 10 days, and then collapse all at once. Many different qualities of brushes were fitted, with no improvement. The commutation with regard to sparking was perfect, and it was a machine of which he had made dozens of the same construction, mechanically and electrically. The machine was taken off its girders and put on a concrete foundation in the same shop, but the trouble still continued. It was moved into another shop, and had been running satisfactorily, with the same brushes, for 12 months. A second machine was installed where the first one was taken from, an exact duplicate, and the same trouble occurred. He thought he was right in putting the trouble down to atmospheric conditions.

Mr. W. LAWSON hoped that such an exceedingly practical and valuable paper would come under the notice of all manufacturers of electrical machinery. In his opinion it rested with the manufacturers to provide their machines with brush gear so designed that when fitted with a specified form and grade of brush a much higher degree of immunity from brush troubles than had so far been obtained would accrue. Unfortunately, these troubles could not always be detected on test, they frequently did not arise until after the machine had been in service for some time, and it was left to the purchaser to determine by experiment how best he could get over the trouble. That was not as it should be, and he believed the paper would lead to a closer study of the question, and would ultimately result in the elimination of most brush troubles. Until that happy state arrived, the question of standardisation should be approached with the utmost caution. In the paper, the excessive wear sometimes produced on the top of the brush by the pressure finger was ascribed to electrical rather than mechanical effect. It was difficult to account for it in that way, as the greater part of the current passed along the flexible connection. In none of the cases that had come to the speaker's notice had there been any evidence of electrical effect. The experiment which was described as proving the existence of some kind of electrolytic effect was extremely interesting and important, but it called for further investigation. He had noticed an analogous effect, and one that was not explained, or even referred to, in text-books, in meters of the mercury-motor type. In this case there was an amalgamated copper disk immersed in mercury. Two copper conductors amalgamated at the ends made contact with the mercury, and the current passed from one conductor through the mercury and the copper disk, and out by the other conductor. Under certain rare conditions electrolytic action took place; one of the copper conductors was eaten away, and a heavy deposition of copper by transference took place on the copper disk. He had never known of such a thing happening with a meter of less than 50 amperes capacity, so that it appeared there was a critical value of current below which no deposition could take place. Had the author observed a similar characteristic in the electrolytic effect which he mentioned? Further investigation might establish an analogy between these two effects, and also throw some light on the possibility of there being some relation between the speed of the conductor and the strength of the current determining the condition under which electrolytic effects could take place.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Wire-Splicing Tool.

Mr. C. H. WILLEY describes in the American *Electrical Review* the tool shown in fig. 1, which is found suitable for splicing small wire which is too stiff to be readily bent with the fingers; it is about 8 in. long, and at the widest part is approximately 3 in. wide. The curved head or holding part is about 1¼ in. wide. This head is bent to form a semi-circle having a diameter of about ¾ in. The grooves in the flanges on each side should be deep enough to hold the wire without slipping out and the shoulder of the flange should be low enough to permit the wire to be grasped easily. The operation of the tool can best be explained by the illustration as shown in fig. 2. One of the wires to be spliced should be

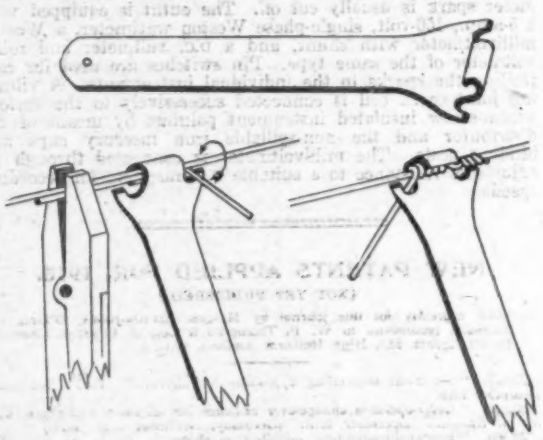


FIG. 1.—HANDY SPLICING TOOL (TOP).
FIG. 2.—METHOD OF STARTING SPLICE (LEFT).
FIG. 3.—FINISHING SPLICE (RIGHT).

bent at right angles and the tool placed over it at the bend. The other wire is then put in position and both wires are held in place with a pair of pliers. By turning the splicing tool, as shown in fig. 2, the wire to be bent can be wound tightly around the other wire. After this the other wire can be bent, and the operation repeated, except that the tool must be turned in the opposite direction. One distinct advantage which a tool such as this possesses is that the finished joint is free from the usual outstanding ends which very often cut through the insulation after being in service a short time.

Spark Recorder Used in Testing Apparatus.

In the *Electrical World*, Mr. F. W. SPRINGER describes a portable recording instrument shown in the accompanying illustration (fig. 4) which was designed and built in the electrical engineering department of the University of Minnesota

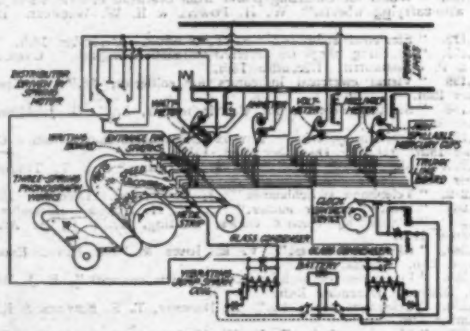


FIG. 4.—APPARATUS FOR RECORDING SIMULTANEOUS READINGS.

some time ago for recording the readings of any indicating instrument. Its principal use is in testing electric cars, elevators, and starters or controllers used with various types of A.C. and D.C. motors.

Edison three-spring phonograph motors operate the paper reels and drums and the spark distributor. A laminated board holds 80 bare copper wires uniformly spaced, and laid in suitable slots. The distributor is driven by one of the shafts of the spring motor, although it could be driven by a special electric motor connected with a storage battery if

desired. An H-slot gear-shift is provided, which, together with the centrifugal governor on the spring motor, allows a paper speed of from ½ in. to 4 ft. (5 cm. to 1.2 m.) per minute. The slow speed is used for railway work and the high speed for testing A.C. motor starters and the like. A common two-cell automobile lighting and starting battery is a satisfactory source of energy for the spark coils. The battery should be insulated in order to avoid unnecessary and dangerous differences of potential between the recording instruments and the neighbouring lines and earths. In case of railway tests the apparatus should be connected with the line on the earth side, or the apparatus and operator should be placed on an insulated platform to be considered as an artificial earth of the line being tested. Three-phase tests may be made by using a polyphase wattmeter, but as most tests for which such a recorder might be used are either single-phase or balanced three-phase systems, a single-phase wattmeter only is provided. The current coil is cut in on one line leg and the potential coil may be connected to an artificial neutral. In A.C. work, of course, the shunts are replaced by one current transformer. In D.C. tests the wattmeter spark is usually cut off. The outfit is equipped with a 5-amp., 150-volt, single-phase Weston wattmeter, a Weston millivoltmeter with shunt, and a D.C. voltmeter and millivoltmeter of the same type. Pin switches are used for controlling the sparks to the individual instruments. A vibrating jump-spark coil is connected successively to the various broom-straw insulated instrument pointers by means of the distributor and the non-spillable iron mercury cups and binding posts. The millivoltmeter is connected through an adjustable resistance to a suitable D.C. magneto for recording speeds.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

20,921. "Electrical controlling apparatus for aircraft." T. F. BREWSTER. December 16th.
20,957. "Lever-operated change-over switches for telephone exchanges, &c." M. B. RICHTER. December 16th. (Germany, December 17th, 1917.)
20,960. "Electrically-operated abrading machines." N. G. OLSON. December 16th.
20,961. "Electrical connectors or terminals for stranded conductors." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. AND R. BROOKS. December 16th.
20,965. "Electric arc lamps." H. B. GRYLLS & W. HEAPE. December 16th.
20,976. "Automatic starting and short-circuiting device for asynchronous motors." V. U. F. ANDERSEN & A. F. B. FUERSON. December 16th.
20,988. "Electric accumulators." H. F. JOEL. December 16th.
20,989. "System of telegraphy and apparatus therefor." E. A. DAVIS. December 16th.
20,999. "Electromagnetic apparatus for recording signals." E. S. CAREY. December 16th.
21,009. "Means for attaching and coupling magneto-electric machines to engines." S. L. BAILEY, W. W. DOUGLAS & DOUGLAS MOTORS, LTD. December 17th.
21,017. "Electric motor construction." F. FOSTER. December 17th.
21,018. "Armature cores." J. B. BUSHNELL & BUSHNELL MAGNETO CO. December 17th.
21,020. "Electric switch." W. JOICE. December 17th.
21,024. "Reverse electric motor." C. DOUGLAS & S. HOLDWAY. December 17th.
21,030. "Means for supporting lamps, shades, &c." H. M. MACNAUGHTON JONES. December 17th.
21,033. "Means for illuminating magneto compasses, scientific instruments, &c." C. F. RYLAND. December 17th.
21,052. "High-tension insulators with metal hood." FABBRICA ISOLATORI LIVORNO & J. E. POLLAK. December 17th.
21,053. "Insulators." FABBRICA ISOLATORI LIVORNO & J. E. POLLAK. December 17th.
21,109. "Wheel for collecting power from overhead electric wires or cables and wire-carrying wheels." W. H. POWELL & E. W. WAGGETT. December 18th.
21,110. "Electrical switches." R. T. NORTON. December 18th.
21,115. "Sparking plugs for internal-combustion engines." CASTLE MOTOR CO. & P. GREENSMITH. December 18th.
21,139. "Visual electrical indicators for collieries, &c." J. KING. December 18th.
21,158. "Starting switches for electric motors, &c." G. J. MONEY. December 18th.
21,177. "Ignition systems." DAYTON ENGINEERING LABORATORIES CO. December 18th. (U.S.A., December 22nd, 1917.)
21,229. "Magnetos." E.I.C. MAGNETOS, LTD., & W. T. TURNER. December 19th.
21,252. "Telephone switchboards." J. H. TAYLOR. December 19th.
21,269. "Electric bell or buzzer." C. W. H. HONOR. December 19th.
21,281. "Glands for electric cables, shafting, &c." G. A. ASHWORTH. December 19th.
21,283. "Electric switches." V. E. JOYCE & PARK ROYAL ENGINEERING WORKS, LTD. December 19th.
21,285. "Production of high-frequency electric currents." F. J. BROUGHAM & M. DEUTCH. December 19th.
21,288. "Telephone boxes, &c." D. DAFONTE, T. F. NEWMAN & E. TONET. December 19th.
21,290. "Electric switches." H. W. F. IRELAND & H. LUCAS. December 19th.
21,298. "Apparatus for electrically controlling railway signals." A. MONARD. December 19th. (France, December 20th, 1917.)
21,307/8/10. "Insulators for high-tension electric cables." FABBRICA ISOLATORI LIVORNO & H. WADE. December 19th.
21,309. "Means for fixing electric cables to insulators." FABBRICA ISOLATORI LIVORNO & H. WADE. December 19th.
21,311. "Magnetos." COMPAGNIE GENERALE DE MAGNETOS. December 19th. (France, July 12th.)
21,363. "Electrical generators and electrical motors." J. SHEPHERD. December 20th.
21,373. "Lamps for vehicles, &c." E. G. CAMELINAT. December 20th.
21,391. "Wireless signalling systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) December 20th.
21,407. "Apparatus for electrically controlling railway signals." A. MONARD. December 20th. (France, May 29th.)
21,417. "Electromagnetic transmission and reception arrangements." W. E. BARKER. December 20th.
21,435. "Connection of flexible cables or leads to electric lampholders, &c." C. A. MILLER, F. J. MILLER & E. A. SANDERS. December 21st.
21,457. "Commutators for dynamo-electric machines." E. J. HARMAN AND E. LE BAS. December 21st.
21,458. "Dynamo-electric machines." E. J. HARMAN & E. LE BAS. December 21st.
21,466. "Measurement of alternating-current power." FERRANTI, LTD., AND G. WALL. December 21st.
21,467. "Electric starters for internal-combustion engines." A. H. MIDGLEY & C. A. VANDERVELL & Co. December 21st.
21,477. "Raising frequency of alternating currents." B. CLUZEAU. December 23rd. (France, February 15th, 1916.)
21,489. "Dynamos." H. LEITNER. December 23rd.
21,490. "Means for obtaining single-phase alternating electric currents from three phase or *vice versa*." A. M. TAYLOR. December 23rd.
21,506. "Electric arc lamps." A. G. WAY & WESTMINSTER ENGINEERING CO. December 23rd.
21,541. "Electric furnaces." D. F. CAMPBELL. December 23rd.
21,547. "Electric cooking or heating vessels, &c." C. H. LAUTH. December 23rd.

[Patent No. 29,285, mentioned in the ELECTRICAL REVIEW for December 30th, p. 616, was the joint application of E. H. Whittall & B. J. Rees, not of the former alone, as stated in our list.]

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

3,394. REGULATING OR CONTROLLING SYSTEMS FOR ELECTRIC MOTORS. Electric and Ordnance Accessories Co. & J. Etchells. March 7th, 1917. (121,138.)
13,225. APPARATUS FOR THE RECEPTION AND UTILISATION OF ELECTRIC CURRENT IMPULSES AND SUITABLE FOR WIRELESS OR OTHER TELEGRAPHY AND TELEPHONY. W. J. Lyons & Selective Signal Co. September 14th, 1917. (121,144.)
15,505. ELECTRIC MUFFLE FURNACES. W. F. Jones. October 25th, 1917. (120,944.)
15,821. TEST SHEATH JOINT FOR ELECTRIC CABLES. C. J. Beaver & E. A. Claremont. October 30th, 1917. (120,948.)
16,154. CELLS FOR ELECTRIC ACCUMULATORS OR BATTERIES. Etablissements de Dion-Bouton Soc. Anon. January 11th, 1917. (112,927.)
17,410. ELECTRIC IGNITING TORCH. A. E. Long & H. Seal. November 26th, 1917. (120,960.)
17,431. ELECTRIC CABLES. W. T. Henley's Telegraph Works Co. & H. Savage. November 26th, 1917. (120,962.)
17,471. ENGINE STARTERS. V. Bendix. November 26th, 1917. (121,155.)
17,675. COMMUTATORS FOR DYNAMOS OR MOTORS. H. C. H. Smyth & Tredelect Engineering Co. November 29th, 1917. (120,982.)
17,823. STARTING MECHANISM FOR MAGNETOS OF INTERNAL-COMBUSTION ENGINES. L. Johnson & J. T. Roberts. December 1st, 1917. (121,168.)
17,849. DYNAMO-ELECTRIC MACHINES. Bruce Pebbles & Co. & H. E. Webb. December 3rd, 1917. (121,170.)
17,871. ELECTRIC SPEED-CHANGING MECHANISM. J. Carlier. December 3rd, 1917. (120,987.)
17,941. LEADING-IN WIRES OR CONDUCTORS OF INCANDESCENT ELECTRIC LAMPS, HIGH-VACUUM APPARATUS, AND THE LIKE. F. Hoge. December 4th, 1917. (121,173.)
18,043. IGNITION STARTING APPARATUS FOR INTERNAL-COMBUSTION ENGINES. Soc. d'Electricite Nilmelior. March 2nd, 1917. (115,801.)
18,057. MAGNETO IMPULSE DEVICES FOR STARTING PURPOSES. B. Lawrence. December 5th, 1917. (121,181.)
18,102. WOOD SEPARATORS FOR SECONDARY ELECTRIC BATTERIES. Chloride Electric Storage Co. & B. Heap. December 6th, 1916. (121,188.)
18,340. ELECTRICAL SEPARATION OF SUSPENDED PARTICLES FROM GASEOUS BODIES. H. A. Burns. December 11th, 1917. (120,994.)
18,490. ELECTRICAL INSTRUMENTS OF THE RECORDING TYPE. E. Fawssett. December 13th, 1917. (120,999.)
18,495. ENGINE STARTERS. V. Bendix. December 13th, 1917. (121,000.)
18,954. TESTING OF INSULATED ELECTRIC CABLES, WIRES, AND THE LIKE. P. M. Bennett, J. F. Watson and Callender's Cable & Construction Co. December 21st, 1917. (121,204.)
19,098. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES AND THE LIKE. J. E. Gimbert. December 27th, 1917. (121,008.)

1918.

31. ELECTRIC HEATING ELEMENTS. L. G. Caunter January 2nd, 1918. (121,210.)
386. ELECTRICALLY-PROPELLED VESSELS. F. Ljungström. January 7th, 1918. (121,211.)
557. SILENCING PADS FROM TELEPHONE OR SPEAKING-TUBE EARPIECES AND EAR-STOPPERS. A. C. Brown. January 9th, 1918. (121,016.)
1,031. ELECTRIC HEATING APPARATUS. Automatic Telephone Manufacturing Co., C. H. Archer & G. W. Simister. January 18th, 1918. (121,214.)
1,567. PLUNGER-TYPE BRUSH-HOLDERS FOR DYNAMO-ELECTRIC MACHINES. Phœnix Dynamo Manufacturing Co. & A. H. Bennett. January 26th, 1918. (121,217.)
1,690. COOLING OR VENTILATION OF DYNAMO-ELECTRIC MACHINES. G. A. Juhlin and J. S. Peck. January 29th, 1918. (121,218.)
1,942. WIRELESS VALVES. C. J. Blue. April 22nd, 1918. (121,220.)
2,040. AIR-COOLED SPARKING PLUG. J. H. Chapman. February 5th, 1918. (121,222.)
2,912. ELECTRICALLY-OPERATED FRICTION CLUTCHES. M. Walker & H. T. Boothroyd. February 19th, 1918. (121,229.)
3,283. ELECTRIC CONTROLLERS OF THE BARREL TYPE. Veritys, Ltd., & W. G. Pipkin. February 25th, 1918. (121,041.)
3,478. ATTACHMENT OF TELEGRAPH WIRES TO THE INSULATORS OF TELEGRAPH POLES AND LIKE SUPPORTS OF AERIAL WIRES. W. A. Davis. February 27th, 1918. (121,044.)
4,375. ELECTRICAL CONDENSERS. W. Dubilier. January 16th, 1918. (121,050.)
5,110. ELECTRIC MOTOR CONTROLLERS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 22nd, 1918. (121,057.)
5,286. DYNAMO-ELECTRIC MACHINES. W. F. Higgs. February 13th, 1918. (Divided application on 2,573/18.) (121,058.)
5,322. CIRCUIT-BREAKERS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 26th, 1918. (121,059.)
6,707. MACHINE SWITCHING TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. & L. Polinkowsky. April 20th, 1918. (121,247.)
10,769. ELECTROMAGNETIC RELAY FOR RAILWAY SIGNALLING AND LIKE PURPOSES. Tyer & Co. and F. W. Leake. June 29th, 1918. (121,088.)
11,230. ELECTROMAGNETIC RELAYS. British Westinghouse Electric & Manufacturing Co. August 7th, 1917. (118,603.)
15,906. DEVICES FOR DETACHABLY CONNECTING ELECTRIC CONDUCTORS TO THE TERMINALS OF MAGNETOS AND OTHER ELECTRICAL APPARATUS. G. F. Joseph and A. G. Harding. September 20th, 1918. (121,105.)
15,701 IGNITION DYNAMOS. C. T. Mason. June 28th, 1917. (Divided application on 9,305/17.) (121,100.)